MYCOLOGIA

VOL. XX MARCH–APRIL, 1928 No. 2

LARS ROMELL

C. L. SHEAR

(WITH PLATE 7)

It was with the deepest regret that I learned from Mr. L. G. Romell of the death of his father which occurred on August 13, 1927. I take pleasure in complying with Mr. Romell's request that I prepare a biographical sketch of his father for MYCOLOGIA, of which he was an Associate Editor. My acquaintance with Doctor Romell began with correspondence and exchange of specimens thirty-five years ago and I had the pleasure of visiting him three times in Stockholm and making several collecting trips with him about Stockholm and Upsala.

Doctor Romell was born at Kumla province of Närke, Sweden, December 4, 1854. I unfortunately have little information in regard to his early life. His deep interest in the fungi apparently developed during his university training. After the usual preliminary training he entered the University of Upsala and received the degree of Bachelor of Arts in 1885. In 1886 he was appointed professor at the College of Norra Latinläroverket, at Stockholm, which position he occupied until 1887, when he became adjunct master at Östermalms Läroverk in Stockholm. In 1890 he took up work as a patent attorney and this was his occupation until his death.

His deep interest in the fungi was aroused and stimulated by H. von Post of Upsala who had been associated with the great mycologist Elias Fries, and had made a large collection of colored plates of fungi which had been determined by Fries himself. In

[MYCOLOGIA for January–February (20: 1–47) was issued January 3, 1928]

this way Romell became imbued with the spirit and traditions of Fries. He therefore, on account of his access to the illustrations and personal knowledge supplied him by von Post, and the unpublished material of Fries, was unusually equipped for making critical interpretations of the Friesian species of the higher fungi.

Doctor Romell never neglected an opportunity to do mycological work. Whether his devotion to the fungi ever led him to neglect his work as a patent attorney we can not say. In any case his field excursions undoubtedly improved his physical condition and increased his capacity for office work. During my visits in Sweden he always insisted on accompanying me on collecting trips. This was a great pleasure and benefit as he was familiar with all the good collecting localities and his enthusiasm and knowledge of the higher fungi were very enjoyable and helpful. His intimate acquaintance with the higher fungi was derived largely from his field work. He was an acute observer and recognized the distinctive characters between closely related species as they occur in the field at different times and under different conditions. He spent much time during his later years in helping to arrange the collections of fungi in the Swedish State Museum of Natural History which contains a great collection of Doctor Rehm and also the Bresadola Herbarium. The latter he purchased with his own funds and deposited in the museum herbarium. He also accumulated a large private herbarium of fungi by collection and exchange, and had a large number of photographs of fungi, and several thousand microscopical preparations. A list of his publications, which includes thirty-five or more titles, can not be included here for lack of space. Besides his unpublished papers he issued two centuries of fungi exsiccati, chiefly from Scandinavia. Most of his critical studies were devoted to the Hymenomycetes, especially *Polyporus* and *Russula*.

His alma mater, the University of Upsala, conferred the Doctor's degree *honoris causa* upon him in 1927, but the promotion was not to take place until September. His laurel crown from the faculty was presented, however, at his funeral.

His son to whom we are indebted for most of the information in this sketch tells me that he was very much interested in spiritualism and occultism. His early plans when leaving home

were to become a pastor or missionary. During his University career, however, he abandoned his fundamentalist ideas and previous plans. On account of his unorthodox teaching he was obliged later to give up that profession. During the world war he bought and distributed large numbers of pamphlets opposing the conflict. He also tried to bring influence to bear in opposition to the war by writing to the Empress of Germany and to the Pope. In connection with these activities his son remarks: "He had, alas, too great a belief in the power of reason, truth, and right in the world."

By Doctor Romell's death, mycology has lost an enthusiastic and able worker, and the world an ardent advocate of truth and justice.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

STUDIES IN TROPICAL ASCOMYCETES—IV
SOME HYPOCREALES FROM TRINIDAD

Fred J. Seaver

(With Plates 8–12)

During the winter and spring of 1921 the writer obtained a rather large collection of fungi from the island of Trinidad of which only the rusts have been reported up to this time.[1]

The fungi of other groups have been determined so far as possible but no attempt has been made to publish them in full. Since a number of interesting Hypocreales have come to hand it is thought worth while to report on some of these now and they will be mentioned in order of their interest.

Probably to me the most interesting was the marble-like growth on the stems of some grass or possibly young bamboo. This has the appearance of an insect gall but differs in that it is very lightly attached to its host, and really constitutes a globose stroma of a Hypocreaceous fungus, rusty-red or yellowish in color, the color varying with age. Cushion-like areas represent the fertile portion, a large part of the surface remaining sterile.

This was at first referred by us to the genus *Hypocrella* which its fruiting character would suggest. Later it was identified by Mr. T. Petch of Ceylon as *Ascopolyporus polychrous* Möller. The name *Ascopolyporus* was apparently suggested because of the resemblance of the stroma to the sporophore of a *Polyporus* with its upper sterile and lower fertile surface. In our specimens the fertile areas do not seem to be confined to the lower surface. Except for the smaller size our collection compares very favorably with the colored illustration by Möller.[2]

A single collection of this species was made in Trinidad, consisting of one mature stroma about a centimeter in diameter, one

[1] Arthur, J. C. Uredinales collected by Fred J. Seaver in Trinidad. Mycologia **14**: 12–24. 1922.

[2] Möller, A. Phycomyceten und Ascomyceten; Untersuchungen aus Brasilien 300. pl. 3, f. 41–44. 1901.

about half this size and two smaller ones. From the ease with which they become detached we assume that this genus like its close relative *Hypocrella* is not parasitic on the plant host but probably entomogenous, although there was no direct evidence of insect hosts. The dried plants are decidedly hard and woody, another character which may have suggested the name *Ascopolyporus*.

So far as we are aware this is the first time the species has been collected in Trinidad, previous records having been confined to Brazil, the type locality. The species was originally reported on bamboo. Our specimen was on some undetermined grass, possibly young bamboo.

The next most interesting species was *Hypocrella viridans* (Berk. & Curt.) Petch. This species was described by Berkeley and Curtis from material collected in Cuba and was based on sterile specimens. For this reason it was placed with the doubtful species of *Hypocrea* by the writer in North American Flora (**3**: 35. 1910). Petch[3] was the first to observe and record the perfect stage of this fungus, placing it in its correct genus. He gives for the species the following synonyms: *Hypocrea viridans* Berk. & Curt.; *Aschersonia viridans* (Berk. & Curt.) Pat.; *Aschersonia disciformis* Pat.; *Hypocrea amazonica* Cooke; and *Aschersonia viridula* Sacc. All of these names refer to the *Aschersonia* stage. Material collected by Dr. Roland Thaxter in Trinidad apparently furnished data for the connection between the *Aschersonia* and the *Hypocrella* stages.

Our own material which was later determined by T. Petch of Ceylon was collected in abundance on the leaves of an aroid, *Anthurium aripoense*, in the vicinity of the guacharo caves. The stromata are thickly scattered over the leaves of the plant host and decidedly green. The perithecia which are present in many of the stromata are numerous and apparently subsuperficial. Whether they become so with age or are normally developed on the surface of the stroma could not be determined but this character is likely to be misleading since the perithecia in the plants of this genus are usually immersed.

[3] Petch, T. Studies in Entomogenous Fungi: II. The Genera Hypocrella and Aschersonia. Ann. Royal Bot. Gard. Perad. **7**: 236. 1921.

The establishment of the connection between the imperfect and perfect stages of this fungus adds to our knowledge of the flora of North America as recorded in North American Flora, in that it removes one species, *Hypocrea viridans*, from the doubtful list, enabling us to place it in its proper genus.

A third species of especial interest is *Hypocrella Andropogonis* (P. Henn.) Petch. While originally described from material collected in Brazil on *Andropogon*, our specimens were collected in Trinidad on a sedge, *Rynchospora cephalotes* (L.) Vahl, although the host had not been determined when the fungus was named by T. Petch. The two plant hosts are so far removed from each other that we suspect the insect hosts may also be very different and that a more critical study may reveal morphological differences in the fungi as well. For the present, however, our Trinidad specimens of *Hypocrella* on *Rynchospora* are referred *Hypocrella Andropogonis* which has previously been known only on *Andropogon*. Petch cites as synonyms of this species *Aschersonia Andropogonis* P. Henn. and *Aschersonia parasitica* P. Henn.

Our material was found to be quite abundant on the leaves of the above named sedge, as many as ten or twelve stromata occurring on a single leaf, the largest ranging up to 5 mm. in diameter. Often several are fused together. They are of a whitish color and while most of them show pycnidia only, several stromata were found which showed the ascigerous stage well developed. Mr. T. Petch in determining the species spoke of it as being rather immature. This species had been previously collected in Trinidad by Dr. Thaxter. It is now known from Brazil, Paraguay and Trinidad.

Another species which was collected in abundance in Trinidad is *Macbridella striispora* (Ellis & Ev.) Seaver, which was formerly known only from the type collection in Nicaragua and one collection from Porto Rico. The abundant collection from Trinidad has given us the opportunity to make a more extended study of this species.

In May, 1926, Mr. E. W. Mason, Assistant Mycologist of the Imperial Bureau of Mycology of Kew, England, sent the writer some of the ascigerous stage of *Sphaerostilbe Musarum* Ashby which, at Mr. Ashby's suggestion, had been compared with the

type of *Sphaerostilbe longiascus* Möller and found to be the same, except for some minor discrepancies in color, etc.

At Mr. Mason's request this was compared with the type of *Macbridella striispora* (Ellis & Ev.) Seaver and also found to be the same. When the genus *Macbridella* was established for this species the stilbaceous character of the fungus had been overlooked. In fact the conidial stage seemed to be entirely wanting in the specimens examined although present in abundance in the later collections from Porto Rico and Trinidad. This, however, would not affect the validity of the genus provided the brown, striate characters of the spores are sufficient grounds for its segregation from the old genus *Sphaerostilbe*. Also Ellis's specific name has priority over the other names mentioned above. The synonymy of this species would then be as follows:

MACBRIDELLA STRIISPORA (Ellis & Ev.) Seaver, Mycologia **1**: 196. 1909.

Nectria striispora Ellis & Ev.; C. L. Smith, Bull. Lab. Nat. Hist. Univ. Iowa **2**: 398. 1893.

Sphaerostilbe longiascus Möller, Phyc. Ascom. Unters. Brasilien 122. 1901.

Sphaerostilbe Musarum Ashby, Bull. Dept. Agr. Jamaica, N. S. **2**: 112. 1913.

The species is characterized by the very large cylindrical perithecia which are attenuated at the apex. The perithecia are partially covered with a yellow coating of very short and poorly developed tomentum which is more or less evanescent. The upper part of the perithecium is naked and red, the shade varying as in other species of nectriaceous fungi with age and conditions. The ascospores are very large, pale brown at maturity and marked with the peculiar striations which are characteristic of many of the tropical ascomycetes. The conidial stage, or the remains of it, is very conspicuous in some of the material although the perithecial stage is often collected without it. According to Mr. Ashby the conidial stage is easily obtained from the ascospores in culture.

The specimen of *Sphaerostilbe Musarum* which we examined was reported on *Cacao*. Our specimens from Trinidad were

collected on the bark of some undetermined tree. It so closely resembles the former that I suspect it was also on *Cacao*.

Scoleconectria tetraspora was described by the writer in North American Flora based on a specimen collected by F. S. Earle on *Cacao* trunks in Jamaica, the species at that time being known to me only from the type collection. A second collection of this fungus was made by the writer in Trinidad on partially matured pods of *Cacao*. The species is characterized by the groups of perithecia which are associated with a *Verticillium* which may be its conidial stage although no attempt has been made to prove the connection because of the age of the material. The individual perithecia are light yellow and characterized by the coarse bran-like particles with which they are covered. As indicated by the specific name, the asci are 4-spored, another diagnostic character.

Occurring as this fungus does on the blighted fruits of the *Cacao*, I suspect that it may be partially responsible for their blighting and may prove to be of economic importance. In the herbarium of The New York Botanical Garden, I find a specimen which is identical with my species listed by Massee from Grenada under the name of *Calonectria flavida*. I have been unable to locate the place of publication of this species and suspect that it may never have been published.[4] Even though it has, the name is untenable since we have in North America another species by the same name.

Another interesting species listed in North American Flora, from Martinique and Jamaica, is *Nectria rhytidospora* Pat. As the name implies, this species is characterized by the striated spores. In connection with our work on the fungi of Porto Rico, numerous specimens of this species were encountered. The perithecia, however, showed so much variation in appearance and color that they were identified with difficulty. In some cases they are smooth and red with a conspicuous ostiolum while in others they are covered with sulphur-yellow powder and with the ostiolum rather inconspicuous. Our Trinidad collection showed both types of perithecia on the same substratum and this together with the fact that the ascospores from the different types

[4] Miss E. M. Wakefield of Kew Gardens has, in a recent letter, confirmed this suspicion.

of perithecia were identical has led the writer to assume that the apparent difference is due merely to variation. The yellow covering which is occasionally present consists of club-shaped hairs which appear to be rather evanescent. For the present at least we are regarding the different types of perithecia as representing merely phases of the same species, although later investigations might prove otherwise.

Nectria suffulta, originally known from Cuba and later from various islands of the West Indies and Mexico, was collected in Trinidad, the latter specimens occurring on rotting wood and conforming well with the other specimens examined, except that the spores are somewhat smaller. This difference, however, is scarcely sufficient in our opinion to distinguish it specifically. The species is characterized by the large collapsing perithecia and the conspicuous fasciculated hairs and striated ascospores. *Nectria setosa* Ferd. & Winge is a synonym.

A fine collection of *Stilbocrea intermedia* (Ferd. & Winge) Seaver, a species formerly known from Louisiana and the West Indies, was found in Trinidad on the bark of some tree. The species is characterized by its *Hypocrea*-like stroma and its *Stilbum*-like conidial stage.

NEW SPECIES

Podocrella gen. nov.

Like *Podocrea* but with filiform spores.

Podocrella poronioides sp. nov.

Stromata stipitate, the stem gradually expanding above into a fruiting head the fertile upper surface of which is nearly plane or slightly convex, the whole structure somewhat resembling a *Poronia*, brownish-black in color; perithecia strongly protruding, giving the upper surface a papillate appearance; asci reaching a length of 250 μ, 8-spored; spores filiform, reaching a length of 65–75 μ and a diameter of 2.5 μ in the center, gradually attenuated toward either end, about 15-septate (the septa rather difficult to count).

On rotten wood among mosses in the vicinity of Valencia, March 4, 1921 (*Seaver 3017*).

Nectria indusiata sp. nov.

Perithecia isolated but thickly scattered over the upper surface of the leaf, minute, bright red and very rough with bran-like granules, erumpent through the epidermis which is pushed up and usually persists in the form of an indusium or lid; asci clavate, 8-spored, reaching a length of 120–150 μ and a diameter of 20 μ; spores fusoid, slightly s-shaped, 3-septate, hyaline, 55–80 × 7–8 μ.

On a fallen leaf of *Micropolis* sp., Morne Bleu, March 13, 1921 (*Seaver 3176*).

In the preparation of this paper the writer is indebted to Mr. T. Petch of Ceylon; Dr. Roland Thaxter of Harvard University and Miss E. M. Wakefield of Kew Gardens, England, for aid in identifying material; also to Dr. N. L. Britton and Mr. Percy Wilson of our own institution for determination of hosts.

THE NEW YORK BOTANICAL GARDEN,
BRONX, NEW YORK CITY

EXPLANATION OF PLATES

PLATE 8

Figs. 1–3. *Podocrella poronioides:* 1–2, habitat sketches enlarged; 3, asci and spore removed from the ascus.

Figs. 4–5. *Ascopolyporus polychrous:* 4, habitat sketch a little enlarged; 5, portion of ascus with spores.

Figs. 6–8, *Macbridella striispora:* 6, habitat sketch enlarged; 7, ascus with spores; 8, conidiospore.

PLATE 9

Figs. 1–3. *Hypocrella viridans:* 1, habitat sketch about natural size; 2, pycnidial stroma with pycnidia arranged in a circle; 3, pycnospores removed from pycnidia.

Figs. 4–8. *Hypocrella Andropogonis:* 4, habitat sketch about natural size; 5, pycnidial stroma enlarged; 6, pycnospores removed; 7, ascigerous stroma enlarged; 8, portion of ascus with spores.

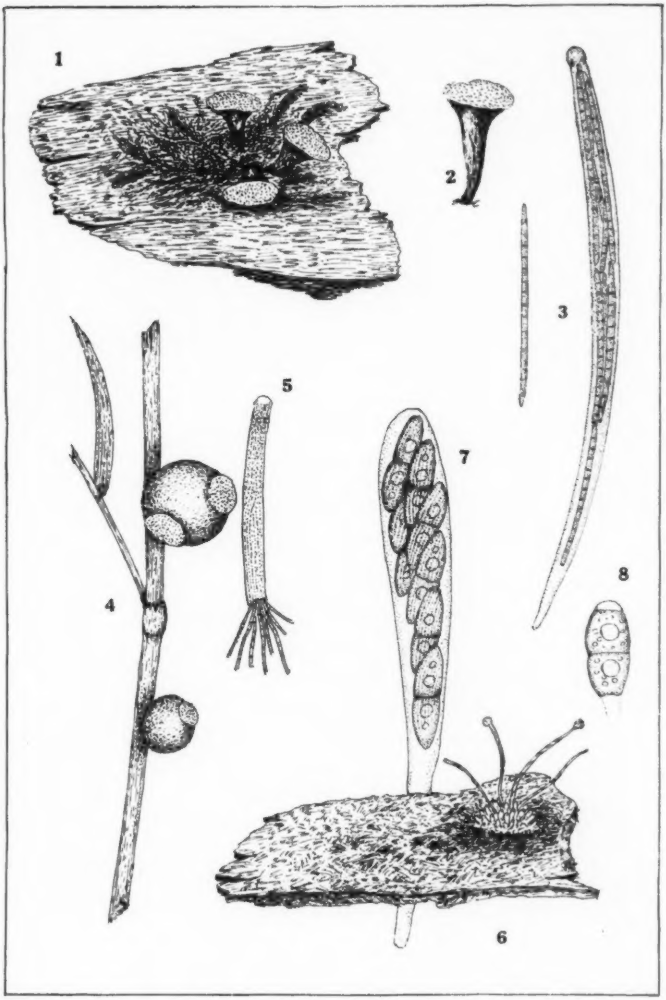
PLATE 10

Figs. 1–3. *Calonectria indusiata:* 1, habitat sketch about natural size; 2, perithecia enlarged; 3, ascus with spores.

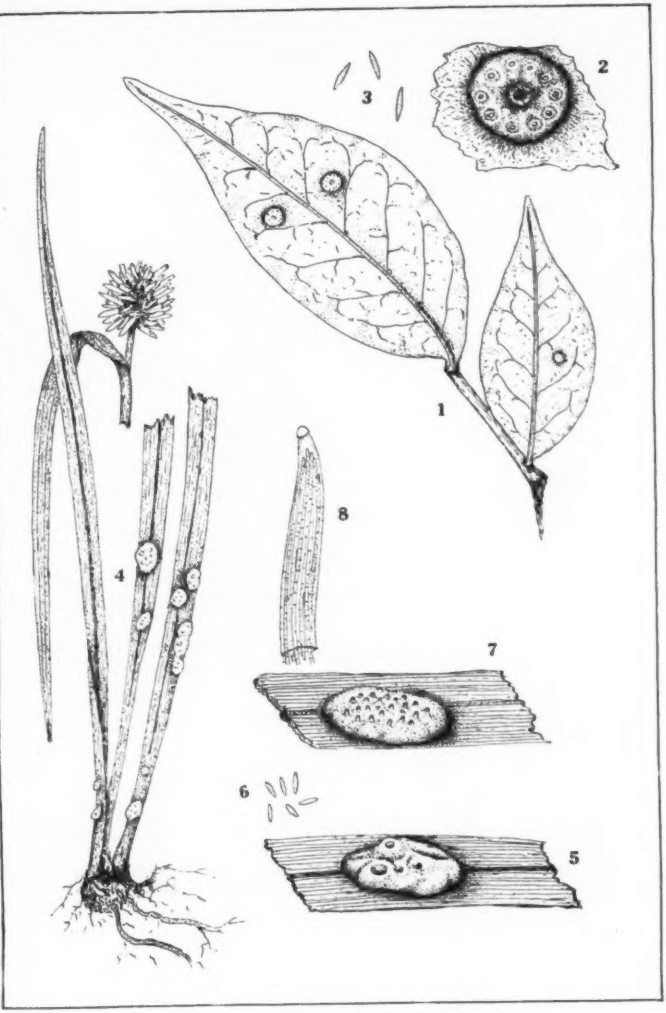
Figs. 4–6. *Hypocrella viridans:* 4, habitat sketch about natural size; 5, ascigerous stroma enlarged; 6, ascus with one spore removed.

PLATE 11

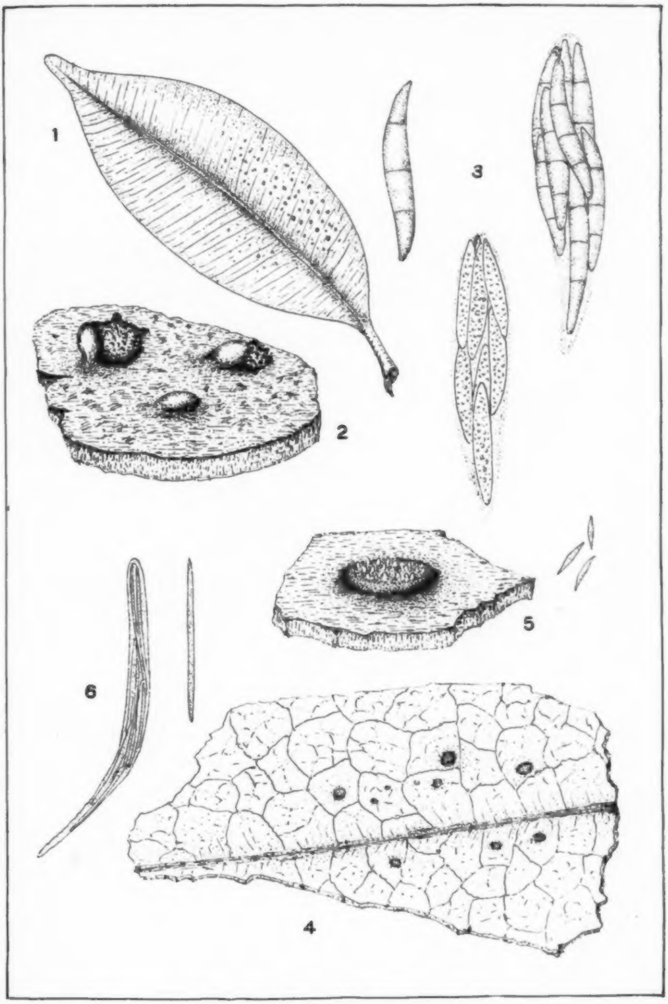
Figs. 1–4. *Scoleconectria tetraspora:* 1, habitat sketch about natural size; 2, cluster of perithecia enlarged; 3, individual perithecia isolated; 4, ascus with spores.



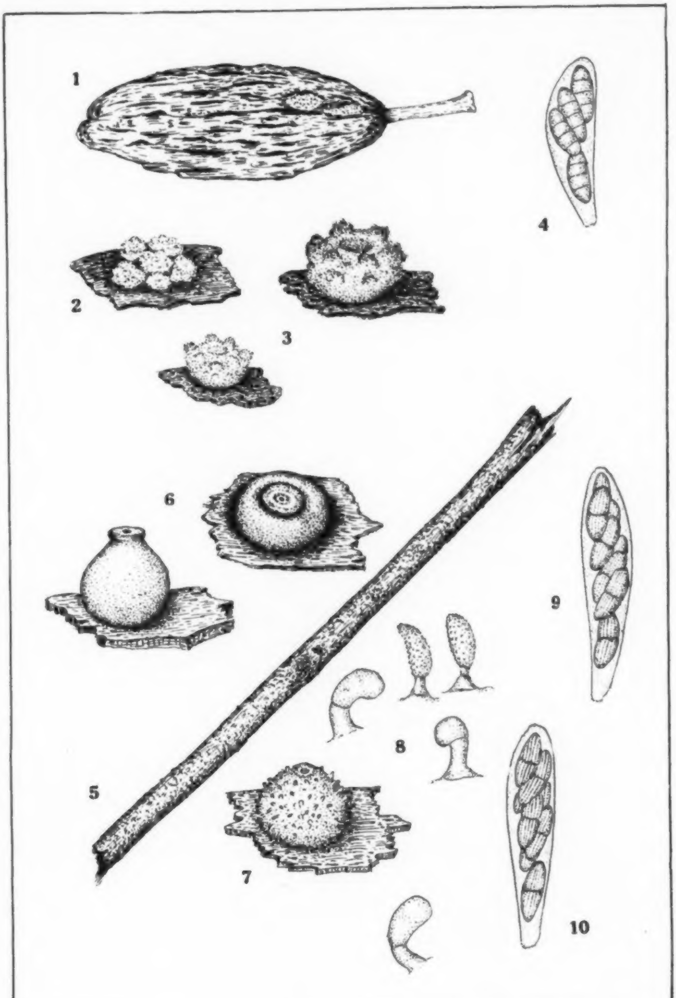
1–3. PODOCRELLA PORONIOIDES
4–5. ASCOPOLYPORUS POLYCHROUS
6–8. MACBRIDELLA STRIISPORA



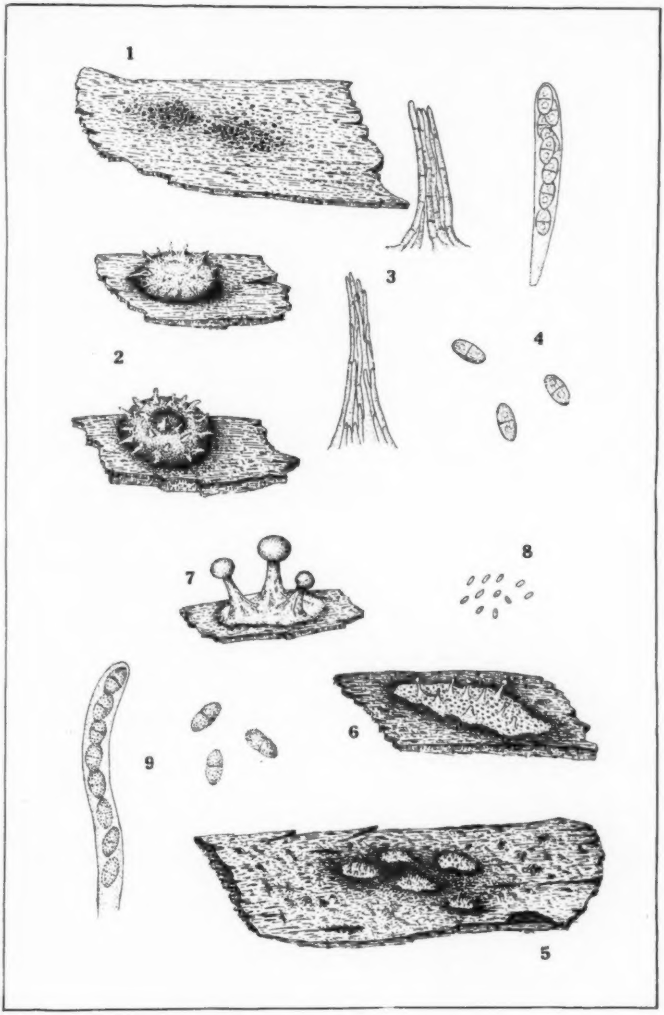
1–3. HYPOCRELLA VIRIDANS
4–8. HYPOCRELLA ANDROPOGONIS



1–3. CALONECTRIA INDUSIATA
4–6. HYPOCRELLA VIRIDANS



1–4. SCOLECONECTRIA TETRASPORA
5–10. NECTRIA RHYTIDOSPORA



1–4. NECTRIA SUFFULTA
5–8. STILBOCREA INTERMEDIA

Figs. 5–10. *Nectria rhytidospora:* 5, habitat sketch about natural size; 6, perithecia isolated, smooth type; 7, perithecium with yellow hair-like structures; 8, hair-like structures from perithecium; 9–10, asci with spores.

PLATE 12

Figs. 1–4. *Nectria suffulta:* 1, habitat sketch about natural size; 2, perithecia isolated and enlarged; 3, fasciculate hairs from perithecium; 4, ascus and ascospores.

Figs. 5–9. *Stilbocrea intermedia:* 5, habitat sketch about natural size; 6, stroma enlarged; 7, conidial stage enlarged; 8, conidia; 9, ascus and ascospores.

Microscopic drawings made with the aid of the camera lucida.

FUNGI OF SANTO DOMINGO—II. UREDINALES[1]

Frank D. Kern

A botanical expedition was made to Santo Domingo in the spring of 1926 by Rafael A. Toro, of the Insular Experiment Station, Porto Rico, and the writer. We reached the island March 9 and left April 1. The trip was made possible by the cooperation of the Department of Agriculture and Labor of Porto Rico and the University of Porto Rico. All kinds of fungi were collected. The writer was especially interested in the rusts. Altogether about 400 numbered collections were made.

In a paper entitled "Fungi of Santo Domingo—I" (Mycologia **19**: 66–84, 1927) Toro has reported on the collections of Phycomycetes, Ascomycetes, and Fungi Imperfecti. His paper reports 97 species. Prior to this paper, published reports of the fungi of Santo Domingo have been scattered and are comparatively meager. In his paper, Toro reviews very thoroughly the literature dealing with Santo Domingan fungi.

The present paper reports the collections of rusts made by Kern and Toro. In the following list our names and the year are omitted for our collections. In addition to our collections, I am including some made by Doctor M. F. Barrus, of Cornell University, who collected in Santo Domingo during January and February, 1926. Since the publication of this paper has been delayed, I am able to include some specimens collected in May, 1927, by Mr. Carlos E. Chardon, Commissioner of Agriculture of Porto Rico. Doctor Barrus and Mr. Chardon have generously turned over to me their specimens for study and record. Full data are included for specimens by other collectors. A few specimens are included which were contributed by Doctor R. Ciferri, Director of the Agricultural Experiment Station of Santo

[1] Read before the Mycological Section of the Botanical Society of America at the Philadelphia meeting, December 29, 1926. Contribution from the Department of Botany, The Pennsylvania State College, No. 60. Published by permission of the Director of the Agricultural Experiment Station, No. 444.

Domingo. We are further indebted to Doctor Ciferri for assistance and many courtesies extended while we were in Santo Domingo. We are likewise indebted to Mr. Rafael A. Espaillat, Secretary of Agriculture of Santo Domingo, and to Mr. Santiago Michelena, of Santo Domingo. For aid in the determination of hosts, I am indebted to Doctor N. L. Britton and Mr. Percy Wilson, of The New York Botanical Garden, Doctor P. C. Standley, of the United States National Museum, Professor A. S. Hitchcock, and Mrs. Agnes Chase, of the United States Department of Agriculture. To all of these and to the administrative officers of the Department of Agriculture and Labor of Porto Rico and of the University of Porto Rico, thanks are due and are hereby most heartily accorded.

Previous reports of rusts from Santo Domingo are to be found chiefly in the North American Flora, Volume 7, and in a series of papers written jointly by Doctor R. Ciferri and Doctor Romualdo Gonzalez Fragoso and published in the Boletin de la Real Sociedad Española de Historia Natural. These papers are entitled "Hongos Parasitos y Saprofitos de la Republica Dominicana." Eleven papers have appeared up to the present (June, 1927). Thirty rusts have been reported in these two series, 18 in the North American Flora and 12 in the Fragoso-Ciferri papers. Of these 30 species which have been previously reported, 17 are in the list collected by us and 13 are to be found in a supplementary list headed "Species Previously Reported from Santo Domingo, not in the Foregoing List." When a different name is used from the one in the previous report, explanations are included.

During the study of these Santo Domingan collections, the papers dealing with the rust floras of Cuba [2] (Arthur & Johnston) and Porto Rico [3] (Whetzel & Kern) have been most helpful. Consulting these lists has suggested a comparison of the distribution of rusts in these three neighboring islands. The total number of rusts here reported for Santo Domingo, 86, seems small compared with 140 for Cuba and 181 for Porto Rico. This is doubtless due to the fact that the explorations in Santo Domingo have been much less thorough than in the other islands. It has

[2] Memoirs Torrey Club **17**: 97–175. 1918.

[3] Sci. Sur. Porto Rico and Virgin Islands **8**: 111–144. 1926.

been very interesting to me to find that of the 86 species known from Santo Domingo, 56 are known in Cuba and 70 in Porto Rico while 11 are not known in either Cuba or Porto Rico. The following table presents the situation in tabular form by genera.

Genus	Total No. of Species in S. D.	No. of These Species in Cuba	No. of These Species in P. R.	No. not in Cuba or P. R.
Coleosporium	2	2	2	
Phakopsora	3		2	1
Crossopsora	1	1	1	
Cerotelium	2	1	2	
Endophyllum	2	1	2	
Pucciniosira	1	1	1	
Botryorhiza	1	1	1	
Ravenelia	6	3	4	1
Prospodium	2	1	1	1
Tranzschelia	1	1	1	
Kuehneola	1	1	1	
Desmella	1	1	1	
Uromyces	11	8	9	2
Puccinia	39	29	34	3
Aecidium	2	1	1	
Uredo	11	5	7	3
Totals	86	56	70	11

For the sake of brevity no attempt has been made in this list to include synonyms. In order that anyone interested may find the synonymy, descriptive accounts, and distribution, I have included in parentheses under nearly every species a reference to the North American Flora. It has seemed wise to give this citation since at present there is not available an index to Volume 7 of the North American Flora. If a different genus is used in the Flora that information is given and if there is additional data in the "Additions and Corrections" a second reference appears. It is hoped that this will aid materially in tracing the status of the various species in this list. If no reference to the Flora is given, that species is not there reported.

1. COLEOSPORIUM ELEPHANTOPODIS (Schw.) Thüm. Myc. Univ. *953*. 1878. (N. Am. Fl. **7**: 89, 1907; 654, 1924.)

On *Elephantopus mollis* H.B.K., San Cristobal, March 14, II, *91*.

2. **Phakopsora dominicana** sp. nov.

On *Croton angustatus* Urban, San Jose de Las Matas, May 8, 1927, *C. E. Chardon 397.*

III. Telia hypophyllous, gregarious, on hypertrophied spots 1–1.5 mm. in diameter, crowded, sometimes confluent, irregularly orbicular, 0.2–0.3 mm. across, pulvinate, blackish; teliospores united in a compact mass, appearing obscurely catenulate, with 2–7 or more cells in a series, each spore elliptical or cuboidal, 13–17 × 16–30 μ, the wall smooth, smoky, 1–1.5 μ thick, apical wall of outer spores 3–4 μ.

This species differs from *Phakopsora Crotonis* and *P. mexicana* in having smaller spores with thinner and different colored walls. The sori are also much smaller. It is a striking fact that no urediniospores are to be found on this specimen. On the upper side of some of the spots there is some indication of pycnia, but none could be identified in sections.

3. **Prospodium Tabebuiae** sp. nov.

On *Tabebuia* sp., Santiago, March 22, 1926, II, *Kern & Toro 30.*

II. Uredinia hypophyllous, scattered, minute, roundish, 0.1 mm. or less across, early naked, chocolate-brown, ruptured cuticle not evident; paraphyses numerous, united at the bases, fusiform, 10–14 × 32–40 μ, slightly incurved, the wall about 1.5 μ thick, hyaline, smooth; urediniospores globoid, 20–24 × 24–28 μ, the wall indistinctly laminate, the inner portion chestnut-brown, about 2 μ thick, overlaid with thickly irregular hyaline papillae reaching out 2–2.5 μ, the pores distinct, 2, opposite and equatorial.

III. Telia not seen.

Although no telia have been found, the character of the uredinial structures together with the host relationship indicates that this is a species of *Prospodium*. It differs from *P. appendiculatum* and *P. Amphilophii*, which are also on Bignoniaceae, in having the paraphyses united at the bases. It differs from *P. plagiopus*, also on Bignoniaceae, in not having a thick gelatinous layer in the urediniospore-wall. It differs from *P. bahamense* in the thickness and markings of the urediniospore-wall.

4. CROSSOPSORA NOTATA Arth. N. Am. Fl. **7**: 695. 1925.

On *Byrsonima crassifolia* H.B.K., Santo Domingo, March 25, II, *86.*

5. CEROTELIUM DESMIUM (Berk. & Br.) Arth. N. Am. Fl. **7**: 698. 1925.

On *Gossypium* sp., San Pedro de Macoris, March 10, II, *41*.
Gossypium barbadense L., San Francisco de Macoris, August, 1925, *R. Ciferri 858* (specimen—reported in Bulletin Estac. Agron. Haina (R. D.), p. 3, 1926).

Reported by Fragoso & Ciferri (Bol. R. Soc. Esp. Hist. Nat. **25**: 443, 1925) as *Kuehneola Gossypii* (Lagerh.) Arth. on *Gossypium barbadense*.

6. CEROTELIUM FICI (Cast.) Arth. Bull. Torrey Club **44**: 509. 1917. (N. Am. Fl. **7**: 696, 1925.)

On *Ficus Carica* L., Haina, March 15, II, *89;* Bonao, June 14, 1925, *R. Ciferri 397*.

Reported by Fragoso & Ciferri (Bol. R. Soc. Esp. Hist. Nat. **25**: 357, 1925) as *Kuehneola Fici* (Cast.) Butler.

7. ENDOPHYLLUM CIRCUMSCRIPTUM (Schw.) Whetzel & Olive, Am. Jour. Bot. **4**: 49. 1917. (N. Am. Fl. **7**: 700, 1925.)

On *Cissus sicyoides* L., San Pedro de Macoris, March 10, *111;* San Cristobal, March 13, *96*, March 12, *93;* Bajabonico, March 23, *77;* San Francisco de Macoris, Aug. 5, 1918, *John A. Stevenson 7048*.

The Stevenson collection is reported in the N. Am. Fl.

8. ENDOPHYLLUM STACHYTARPHETAE (P. Henn.) Whetzel & Olive, Am. Jour. Bot. **4**: 50. 1917. (N. Am. Fl. **7**: 701, 1925.)

On *Valerianodes cayennense* (L. C. Rich.) Kuntze, Puerto Plata, March 24, *82;* Isabel de Torre, April 28, 1887, *Eggers Phan. no. 1751*.

The Eggers collection is reported in the N. Am. Fl.

9. PUCCINIOSIRA PALLIDULA (Speg.) Lagerh. Tromsö Mus. Aarsh. **16**: 122. 1894. (N. Am. Fl. **7**: 127, 1907; 702, 1925.)

On *Triumfetta semitriloba* Jacq., San Cristobal, March 12, O, III, *114;* Puerto Plata, March 24, *83;* San Pedro de Macoris, March 10, *110*, Jan. 23, 1926, *M. F. Barrus 3*.
Triumfetta sp., La Vega, May 4, 1927, *C. E. Chardon 349*.

10. BOTRYORHIZA HIPPOCRATEAE Whetzel & Olive, Am Jour. Bot. **4**: 47. 1917. (N. Am. Fl. **7**: 703, 1925.)

On *Hippocratea volubilis* L., Santo Domingo, March 27, 1926, *126*.

11. RAVENELIA CAESALPINIAE Arth. Bull. Torrey Club **31**: 5. 1904. (N. Am. Fl. **7**: 141, 1907; 714, 1925.)

On *Mimosa Ceratonia* L., river north of Bonao, May 4, 1927, *C. E. Chardon 345*.

12. RAVENELIA INDIGOFERAE Tranz. Hedwigia **33**: 369. 1894. (N. Am. Fl. **7**: 144, 1907.)

On *Indigofera mucronata* Spreng., La Vega, March 19, II, *12;* Bajabonico, March 23, II, III, *11*.
Indigofera suffruticosa Mill., Santiago, March 20, II, *20;* San Cristobal, March 14, II, *21*.

13. RAVENELIA INGAE (P. Henn.) Arth. N. Am. Fl. **7**: 132. 1907. *Ravenelia Whetzelii* Arth. Mycologia **9**: 64. 1917. (N. Am. Fl. **7**: 707, 1925.)

On *Inga Inga* (L.) Britton, San Cristobal, March 14, O, I^{II}, II, *92*, II (on seedlings), *90*.

14. RAVENELIA LONCHOCARPI Lagerh. & Diet. Hedwigia **33**: 46. 1894. (N. Am. Fl. **7**: 717, 1925.)

On *Lonchocarpus domingensis* DC., Bonao, March 16, II, *32*.

15. RAVENELIA PORTORICENSIS Arth. Bull. Torrey Club **31**: 5. 1904. (N. Am. Fl. **7**: 139, 1907; 716, 1925.)

On *Isandrina emarginata* (L.) Britton & Rose (*Cassia emarginata* L.), Barahona, Jan. 26, 1926, II, *M. F. Barrus 8*.

This rust was originally described from a specimen collected by A. A. Heller in 1902 at Ponce, Porto Rico. It has been reported previously from Santo Domingo, having been found on a phanerogamic specimen in The New York Botanical Garden, Barahona, May, 1910, II, *Pater Fuertes 192*. It is known also from Cuba, Haiti, and Jamaica (see Mem. Torrey Club **17**: 118, 1918).

16. RAVENELIA SPINULOSA Diet. & Holw. Bot. Gaz. **31**: 336. 1901. (N. Am. Fl. **7**: 140, 1907; 716, 1925.)

On *Cassia crista* Jacq., Azua, March 29, II, *16*.

This rust has not been reported previously from the West Indies. It has been known from Mexico and Guatemala.

17. PROSPODIUM APPENDICULATUM (Wint.) Arth. Jour. Myc. **13**: 31. 1907. (N. Am. Fl. **7**: 160, 1907; 725, 1925.)

On *Tecoma Stans* (L.) H.B.K. (*Stenolobium Stans* Seem.), Santiago, March 20, 1926, II, *119*.

18. KUEHNEOLA MALVICOLA (Speg.) Arth. N. Am. Fl. **7**: 187. 1912. (N. Am. Fl. **7**: 730, 1925.)

On *Pavonia coccinea* Cav., Bani, March 28, II, *7*.

19. DESMELLA SUPERFICIALIS (Speg.) Syd. Ann. Myc. **16**: 242. 1918. (N. Am. Fl. **7**: 704, 1925.)

On *Dryopteris subtetragona* (Link) Maxon, San Cristobal, II, March 13, *50*.

20. UROMYCES APPENDICULATUS (Pers.) Fries, Summa Veg. Scand. 514. 1849. (*Nigredo*, N. Am. Fl. **7**: 257, 1912; 764, 1926.)

On *Vigna repens* (L.) Kuntze, Puerto Plata, March 24, *56*.

21. UROMYCES COLUMBIANUS Mayor, Mem. Soc. Neuch. Sci. Nat. **5**: 467. 1913. (*Nigredo*, N. Am. Fl. **7**: 771, 1926.)

On *Melanthera* sp., Santo Domingo, March 27, II, *127*.

22. UROMYCES DOLICHOLI Arth. Bull. Torrey Club **33**: 27. 1906. (*Nigredo*, N. Am. Fl. **7**: 258, 1912; 765, 1926.)

On *Cajan Cajan* (L.) Millsp., San Cristobal, March 12, II, *112;* Azua, March 15, 1913, *Rose, Fitch & Russell Phan. no. 3920*.

The Rose, Fitch, Russell collection is reported in the N. Am. Fl.

23. UROMYCES GEMMATUS Berk. & Curt.; Berkeley, Jour. Linn. Soc. **10**: 357. 1869. (*Klebahnia*, N. Am. Fl. **7**: 479, 1921.)

On *Jacquemontia nodiflora* (Desv.) G. Don, Santiago, March 22, II, *25*.

24. UROMYCES HEDYSARI-PANICULATI (Schw.) Farl.; Ellis, N. Am. Fungi *246*. 1879. (*Nigredo*, N. Am. Fl. **7**: 248; 761, 1926.)

On *Meibomia scorpiurus* (Sw.) Kuntze, La Vega, March 17, II, *15;* San Pedro de Macoris, Jan. 30, 1926, II, *M. F. Barrus 10*.

Meibomia cana (Gmel.) Blake, Santo Domingo, March 27, II, *27*.

25. UROMYCES IGNOBILIS (Syd.) Arth. Mycologia **7**: 181. 1915. (*Nigredo*, N. Am. Fl. **7**: 746, 1926.)

On *Sporobolus indicus* (L.) R. Br., Puerto Plata, March 24, II, *57;* San Cristobal, March 12, *39;* Haina, March 11, *46;* road Moca to Salcedo, May 7, 1927, *C. E. Chardon 360*.

26. UROMYCES LEPTODERMUS Syd.; Syd. & Butler, Ann. Myc. **4**: 430. 1906. (*Nigredo*, N. Am. Fl. **7**: 224; 746, 1926.)

On *Lasiacis divaricata* (L.) Hitchc., Santiago, March 22, II, *28;* San Cristobal, March 14, II, III, *23*.

Panicum barbinode Trin., San Cristobal, March 12, II, *37, 51;* Haina, March 11, II, *44, 45;* Bajabonico, March 23, II, *66;* San Jose de las Matas, May 8, 1927, II, *C. E. Chardon 398;* San Pedro de Macoris, Feb. 1, 1926, II, *M. F. Barrus*.

Reported by Fragoso and Ciferri on *Panicum maximum* as *Uredo Panici-maximi* Rangel, Haina, September, 1925 (Bol. R. Soc. Esp. Hist. Nat. **25**: 509, 1925). This name is regarded as a synonym of *Uromyces leptodermus* by Arthur (Proc. Amer. Phil. Soc. **44**: 206, 1925).

27. UROMYCES PIAUHYENSIS P. Henn. Hedwigia **47**: 266. 1908. (*Uromyces*, N. Am. Fl. **7**: 589, 1922.) March 20, II, *129*.

On *Wedelia reticulata* DC., Santiago, March 22, II, *131;* La Vega-Moca road, March 20, II, *130;* Puerto Plata, March 24, II, *128*.

Wedelia Ehrenbergii Schlch., road to Salcedo, May 7, 1927, *C. E. Chardon 357*.

28. UROMYCES PROËMINENS (DC.) Pass. Rab. Fungi Eur. *1795*. 1874. (*Nigredo*, N. Am. Fl. **7**: 259, 1912; 765, 1926.)

On *Chamaesyce hirta* (L.) Millsp., Haina, March 30, II, *71;* Puerto Plata, March 24, II, *61;* San Cristobal, March 14, II, *24,* March 11, *9;* San Pedro de Macoris, Feb. 1, 1926, II, *M. F. Barrus 21;* road Moca to Santiago, May 4, 1927, II, *C. E. Chardon 355.*

Chamaesyce hypericifolia (L.) Millsp., Haina, March 30, *70;* Puerto Plata, March 24, I, II, *62;* San Cristobal, March 14, I, II, *52;* road Moca to Salcedo, May 7, 1927, I, II, *C. E. Chardon 359.*

Chamaesyce prostrata (Ait.) Small, Samana, Aug. 2, 1918, *John A. Stevenson 7015.*

The Stevenson specimen is reported in the N. Am. Fl.

29. PUCCINIA ARACHIDIS Speg. Anal. Soc. Ci. Argent. **17**: 90. 1884. (*Bullaria*, N. Am. Fl. **7**: 484, 1922.)

On *Arachis hypogaea* L., Haina, September, 1925, II, *R. Ciferri.*

30. PUCCINIA ARECHAVELATAE Speg. Anal. Soc. Ci. Argent. **12**: 67. 1881. (*Micropuccinia*, N. Am. Fl. **7**: 541, 1922.)

On *Cardiospermum microcarpum* H.B.K., San Cristobal, March 12, *38.*

31. PUCCINIA CACABATA Arth. & Holw. Proc. Am. Phil. Soc. **64**: 179. 1925.

On *Chloris ciliata* Sw., Barahona, Jan. 27, *M. F. Barrus;* Bajabonico, March 23, *78.*

Chloris paraguayensis Steud., Haina, March 30, *103.*

This is apparently the first report of this rust from North America. The type locality is Bolivia, South America. These specimens have urediniospores with brown walls and equatorial pores like this species, not yellowish walls and scattered pores as in *Puccinia Chloridis* Speg.

32. PUCCINIA CANALICULATA (Schw.) Lagerh. Tromsö Mus. Aarsh. **17**: 51. 1894. (*Dicaeoma*, N. Am. Fl. **7**: 344, 1920; 783, 1926.)

On *Cyperus ferax* L. C. Rich., San Cristobal, March 14, II, *17.*

33. PUCCINIA CANNAE (Wint.) P. Henn. Hedwigia **41**: 105. 1902. (*Dicaeoma*, N. Am. Fl. **7**: 380, 1920; 789, 1926.)

On *Canna* sp., Haina, March 11, *134;* Parque Independencia, Santo Domingo, March 9, *133;* San Cristobal, March 13, *132;* Bonao, Aug. 15, 1918, *John A. Stevenson 7004.*

The Stevenson specimen is reported in the N. Am. Fl.

34. PUCCINIA CENCHRI Diet. & Holw.; Holw. Bot. Gaz. **24**: 28. 1897. (*Dicaeoma*, N. Am. Fl. **7**: 294, 1920; 775, 1926.)

On *Cenchrus echinatus* L., Bajabonico, March 23, II, *69;* Haina, March 11, *42;* Barahona, Jan. 27, 1926, *M. F. Barrus.*

Cenchrus viridis Spreng., Bajabonico, March 23, II, *64.*

35. PUCCINIA CHAETOCHLOAE Arth. Bull. Torrey Club **34**: 585. 1907. *Uredo Chaetochloae* Arth. Bull. Torrey Club **33**: 518. 1906. (*Dicaeoma*, N. Am. Fl. **7**: 288, 1920.)

On *Paspalum Lindenianum* Steud., Santiago, March 22, II, *31.*

36. PUCCINIA CYNODONTIS Lacroix, in Desmaz. Pl. Crypt. II. 655. 1859. (*Dicaeoma*, N. Am. Fl. **7**: 315, 1920.)

On *Capriola dactylon* (L.) Kuntze, Santiago, March 20, II, *120;* San Pedro de Macoris, Feb. 1, 1926, II, *M. F. Barrus;* Los Ranchos, May 7, 1927, *C. E. Chardon 380.*

37. PUCCINIA DICHROMENAE (Arth.) Jackson. *Uredo Dichromenae* Arth. Bull. Torrey Club **33**: 31. 1906. (*Dicaeoma*, N. Am. Fl. **7**: 351, 1920.)

On *Dichromena ciliata* Vahl, Bonao, March 16, *18.*

Telia have been found on *Dichromena colorata* in Bermuda and reported by Whetzel and Jackson. The telia are amphigenous, long covered by the epidermis. Arthur previously had referred the species to *Dicaeoma* (N. Am. Fl. **7**: 351, 1920) but without any evidence. This proves that his surmise was correct.

38. PUCCINIA FUSCELLA Arth. & Johnston, Mem. Torrey Club **17**: 157. 1918. (*Bullaria*, N. Am. Fl. **7**: 497, 1922.)

On *Vernonia Spregeliana* Sch.-Bip., Santiago, March 22, 1926, II, III, *125.*

Apparently a new host. This rust heretofore known from

7

Cuba only. The teliospores are broad with a semihyaline thickening above.

39. PUCCINIA GOUANIAE Holw. Ann. Myc. **3**: 21. 1905. (*Bullaria*, N. Am. Fl. **7**: 487, 1922.)

On *Gouania polygama* (Jacq.) Urban, Bajabonico, March 23, II, *101;* San Cristobal, March 13, II, iii, *97*.

Gouania lupuloides (L.) Urban, San Francisco de Macoris, Aug. 5, 1917, *John A. Stevenson 7027*.

The Stevenson specimen is reported in the N. Am. Fl.

40. PUCCINIA HELICONIAE (Diet.) Arth. Bull. Torrey Club **45**: 144. 1918. (*Puccinia*, N. Am. Fl. **7**: 591, 1922.)

On *Bihai Bihai* (L.) Griggs, Santo Domingo, March 25, II, *88*.

40. PUCCINIA HETEROSPORA Berk. & Curt. Jour. Linn. Soc. **10**: 356. 1868. (*Micropuccinia*, N. Am. Fl. **7**: 544, 1922.)

On *Bastardia viscosa* (L.) H.B.K., Santiago, March 21, 1926, *135*.

Gaya occidentalis (L.) Sweet, Puerto Plata, June 4, 1906, *C. Raunkiaer 1202a*.

Sida spinosa L., Bajabonico, March 23, *67;* Puerto Plata, March 24, *59;* San Cristobal, March 13, *49*.

Sida urens L., San Cristobal, March 12, *35*.

Sida sp., Barahona, Jan. 26, 1926, *M. F. Barrus 6*.

The Raunkiaer collection is reported in the N. Am. Fl.

42. PUCCINIA HIBISCIATA (Schw.) Kellerm. Jour. Myc. **9**: 110. 1903. *Caeoma* (*Aecidium*) *hibisciatum* Schw. Trans. Am. Phil. Soc. II. **4**: 293. 1832. (*Dicaeoma*, N. Am. Fl. **7**: 308, 1920; 728, 1926.)

On *Sporobolus Berteronianus* (Trin.) H. & C., Santiago, March 11, II, *29;* Haina, March 11, II, *43*.

This is the first report of this rust on the host here listed and its first report from the West Indies. It is common in the United States and extends into southern Mexico. Arthur reports *Uromyces Sporoboli* on this host from South America but the spores of this specimen are too small for that species. The thickness of the walls and the pore arrangement do not agree with *Uromyces ignobilis*.

43. PUCCINIA HYPTIDIS (Curt.) Tracy & Earle, Bull. Miss. Agric. Exp. Sta. **34**: 86. 1895. (*Dicaeoma*, N. Am. Fl. **7**: 408. 1921.)

On *Hyptis capitata* Jacq. (*Mesosphaerum capitatum* Kuntze), Bonao, March 16, 1926, II, *136;* La Vega, March 19, II, *123.*

44. PUCCINIA IMPEDITA Mains & Holw.; Arth. Mycologia **10**: 135. 1918. (*Bullaria*, N. Am. Fl. **7**: 493, 1922.)

On *Salvia occidentalis* Sw., San Cristobal, March 14, II, *54;* March 13, II, *48;* Haina, March 11, II, *47;* San Pedro de Macoris, Jan. 20, 1926, II, *M. F. Barrus 11.*

45. PUCCINIA INFLATA Arth. Bull. Torrey Club **33**: 516. 1906. (*Bullaria*, N. Am. Fl. **7**: 486. 1922.)

On *Stigmaphyllon lingulatum* (Poir.) Small, Puerto Plata, March 24, II, *137;* Santiago, March 20, II, *118;* La Romana, April 1, II, *102;* San Pedro de Macoris, Jan. 22, 1926, II, *M. F. Barrus 5;* Haina, Oct. 23, 1925, *R. Ciferri.*

Reported by Ciferri and Fragoso (Bol. R. Soc. Esp. Hist. Nat. **26**: 330) as *Puccinia insueta* Wint. This name was founded on a rust from Brazil on some Malpighiaceae. The description given for the Brazilian specimen is very similar to *Puccinia inflata* and it is entirely possible that the two may be the same.

46. PUCCINIA INSULANA H. S. Jackson, Bot. Gaz. **65**: 296. 1918. (*Bullaria*, N. Am. Fl. **7**: 496, 1922.)

On *Vernonia racemosa* Delponte, Santiago, March 21, II, iii, *115.*

Apparently a new host for this species, which heretofore has been known from Porto Rico, St. Croix, Jamaica, Guatemala, and Antigua. The teliospores are long and smooth with hyaline papillae over the germ pores.

47. PUCCINIA INVAGINATA Arth. & Johnston, Mem. Torrey Club **17**: 146. 1918. (*Bullaria*, N. Am. Fl. **7**: 488, 1922.)

On *Gouania lupuloides* (L.) Urban, San Cristobal, March 28, II, *105;* Azua, March 29, II, *75.*

48. PUCCINIA LANTANAE Farl. Proc. Am. Acad. Sci. **18**: 83. 1883. (*Micropuccinia*, N. Am. Fl. **7**: 559, 1922.)

On *Priva lappulacea* (L.) Pers., Bajabonico, March 20, *65;* San Cristobal, March 12, *36;* Los Ranchos, May 7, 1927, *C. E. Chardon 378.*

Lantana involucrata L., Barahona, Jan. 26, 1926, *M. F. Barrus 7.*

49. PUCCINIA LATERITIA Berk. & Curt. Jour. Acad. Sci. Phila. **2**: 281. 1853. (*Micropuccinia*, N. Am. Fl. **7**: 568, 1922.)

On *Borreria laevis* (Lam.) Griseb., San Pedro de Macoris, Feb. 1, 1926, *M. F. Barrus 13.*

50. PUCCINIA LEONOTIDIS (P. Henn.) Arth. Mycologia **7**: 245. 1915. (*Dicaeoma*, N. Am. Fl. **7**: 407, 1921.)

On *Leonotis nepetaefolia* (L.) R. Br., San Cristobal, March 12, II, *113;* Monte Cristi, Aug. 12, 1918, *John A. Stevenson 7001.*

This species has usually been referred by American authors to *Puccinia Leonotidis* (P. Henn.) Arth., the type of which is from South Africa. While it seems probable that the American and African specimens are the same and that this is the proper name to be used, there is a confusion regarding the teliospores. Arthur in the N. Am. Fl. **7**: 407 (1921) gives a description of the telial stage which is evidently from African material based on observations by Hennings (see Mycologia **7**: 245, 1915). The teliospores are described as ellipsoid, 18–23 × 25–32 μ. Fragoso and Ciferri in Bol. R. Soc. Esp. Hist. Nat. **26**: 248 (1926) describe a new species, *Puccinia dominicana* Frag. & Cif., on *Leonotis nepetaefolia*, collected in Moca, Santo Domingo, Jan. 23, 1926, by J. Beccan. The urediniospores seem to be the characteristic ones found on this host. They describe teliospores as subfusoid, 18–22 by 60–90 μ, and their species is founded largely on the difference between these teliospores and those described by Hennings. I am inclined to think that we are dealing here with only one species on *Leonotis* as is indicated so strongly by the urediniospores and that there is an error either in one case or the other regarding the teliospores.

The Stevenson collection is reported in the N. Am. Fl.

51. PUCCINIA LEVIS (Sacc. & Bizz.) Magn. Ber. Deuts. Bot. Ges. **9**: 190. 1891. (*Dicaeoma*, N. Am. Fl. **7**: 286, 1920; 774, 1926.)

On *Panicum fasciculatum* Swartz, San Pedro de Macoris, Feb. 1, II, *M. F. Barrus;* San Cristobal, July, 1921, II, *J. A. Faris* (from phanerogamic specimen); Los Ranchos, May 7, 1927, II, *C. E. Chardon 379.*

Panicum maximum Jacq., Haina, June 26, 1925, *R. Ciferri 830.*

Reported on *Panicum maximum* by Fragoso and Ciferri (Bol. R. Soc. Esp. Hist. Nat. **25**: 357, 1925) as *Puccinia Panici* Diet.

52. PUCCINIA MALVACEARUM Bertero; Mont. in C. Gay, Fl. Chile **8**: 43. 1852. (*Micropuccinia*, N. Am. Fl. **7**: 542, 1922.)

On *Malvastrum corchorifolium* (Desv.) Britton, Bajabonico, March 23, *76.*

Malvastrum coromandelianum (L.) Garcke, Bajabonico, March 23, *63;* La Vega-Moca road, March 20, *33;* road Moca to Salcedo, May 7, 1927, *C. E. Chardon 358.*

53. PUCCINIA MEDELLINENSIS Mayor, Mem. Soc. Sci. Nat. **5**: 497. 1913. (*Dicaeoma*, N. Am. Fl. **7**: 408, 1921.)

On *Hyptis suaveolens* Poir. (*Mesosphaerum suaveolens* (L.) Kuntze), San Pedro de Macoris, Jan. 30, 1926, II, *M. F. Barrus 12, 15.*

54. PUCCINIA MELAMPODII Diet. & Holw.; Holw. Bot. Gaz. **24**: 32. 1897. (*Micropuccinia*, N. Am. Fl. **7**: 581, 1922.)

On *Synedrella nodiflora* (L.) Gaertn., Santiago, March 20, 1926, III, *122;* Bajabonico, March 23, *100;* river near Bonao, May 4, 1927, *C. E. Chardon 343.*

Eleutheranthera ruderalis (Sw.) Sch.-Bip., Haina, March 11, *99;* Barahona, June, 1910, *Pater Fuertes Phan. no. 174.*

The Fuertes collection is the basis of the report in the N. Am. Fl.

55. PUCCINIA OBLIQUA Berk. & Curt. Jour. Linn. Soc. **10**: 356. 1869. (*Micropuccinia*, N. Am. Fl. **7**: 555, 1922.)

On *Funastrum clausum* (Jacq.) Schlecht., San Cristobal, March 14, *53*.

56. PUCCINIA PALLESCENS Arth. Bull. Torrey Club **46**: 111. 1919. (*Dicaeoma*, N. Am. Fl. **7**: 278, 1920.)

On *Zea Mays* L., La Vega-Moca road, March 20, II, *116;* Bajabonico, March 25, II, *87;* La Vega, May 4, 1927, II, *C. E. Chardon 348*.

The Kern and Toro collection, No. *87*, has both *Puccinia pallescens* and *Puccinia Sorghi*.

57. PUCCINIA PSIDII Wint. Hedwigia **23**: 171. 1884. (*Bullaria*, N. Am. Fl. **7**: 488, 1922.)

On *Jambos Jambos* (L.) Millsp., river near Bonao, May 4, 1927, *C. E. Chardon 344*.

58. PUCCINIA PURPUREA Cooke, Grevillea **5**: 15. 1876. (*Dicaeoma*, N. Am. Fl. **7**: 284, 1920; 774, 1926.)

On *Holcus halepensis* L., Haina, March 30, II, *72*.

Holcus Sorghum L. (*Andropogon Sorghum sudanensis* Piper), San Francisco de Macoris, Aug. 18, 1926, *R. Ciferri*.

Ciferri and Fragoso (Bol. R. Soc. Esp. Hist. Nat. **26**: 470, 1926) report *Uromyces Clignyi* Pat. & Har. Jour. de. Bot. **14**: 237, 1900, on *Holcus Sorghum*, the collection cited above. They found urediniospores only. Since the urediniospores of *U. Clignyi* are very similar to those of *Puccinia purpurea* in size, markings, and pores and since the usual rust on this host is *Puccinia purpurea*, I believe the weight of evidence favors the disposition here made. I have not had opportunity to examine the specimen collected by Dr. Ciferri.

59. PUCCINIA RIVINAE (Berk. & Curt.) Speg. Anal. Mus. Nac. Buenos Aires **19**: 304. 1909. (*Dicaeoma*, N. Am. Fl. **7**: 388, 1920.)

On *Trichostigma octandrum* (L.) H. Walt., Salcedo, May 7, 1927, II, *C. E. Chardon 366*.

60. PUCCINIA SCLERIICOLA Arth. Mycologia **7**: 232. 1915. (*Dicaeoma*, N. Am. Fl. **7**: 350, 1920.)

On *Scleria secans* (L.) Urban, Bonao, March 16, II, iii, *19*.

61. PUCCINIA SORGHI Schw. Trans. Am. Phil. Soc. II. **4**: 295. 1832. (*Dicaeoma*, N. Am. Fl. **7**: 277, 1920.)

On *Zea Mays* L., Bajabonico, March 25, II, *87*.

62. PUCCINIA TUBULOSA (Pat. & Gaill.) Arth. Am. Jour. Bot. **5**: 464. 1918. (*Dicaeoma*, N. Am. Fl. **7**: 288, 1920.)

On *Paspalum conjugatum* Berg., Jayabo road to San Francisco de Macoris, May 7, 1927, II, *C. E. Chardon 375*.

Paspalum plicatulum Michx., Santo Domingo, March 27, II, *26*.

Syntherisma sanguinalis (L.) Dulac., Bajabonico, March 23, ii, *68*.

Valota insularis (L.) Chase, Santiago, March 20, II, *121*.

63. PUCCINIA URBANIANA P. Henn. Hedwigia **37**: 278. 1898. (*Micropuccinia*, N. Am. Fl. **7**: 558, 1922.)

On *Valerianodes jamaicense* (L.) Kuntze, La Vega-Moca road, March 20, III, *117;* Haina, March 11, *108;* San Cristobal, March 12, *95;* San Pedro de Macoris, Jan. 21, 1926, *M. F. Barrus 9*.

? *Cornutia pyramidata* L., San Cristobal, March 14, *60;* Puerto Plata, March 24, *58*.

64. AECIDIUM TOURNEFORTIAE P. Henn. Hedwigia **34**: 338. 1895. (*Aecidium*, N. Am. Fl. **7**: 634, 1924.)

On *Tournefortia hirsutissima* L., San Cristobal, March 14, *55*.

65. UREDO ARTOCARPI Berk. & Br. Jour. Linn. Soc. **14**: 93. 1873. (*Physopella*, N. Am. Fl. **7**: 103, 1907.)

On *Artocarpus communis* Forst., La Vega, March 19, II, *124*.

66. UREDO COCCOLOBAE P. Henn. Hedwigia **35**: 253. 1896. (*Uredo*, N. Am. Fl. **7**: 609, 1924.)

On *Coccolobis uvifera* (L.) Jacq., Haina, March 30, II, *104*.

67. UREDO CUPHEAE P. Henn. Hedwigia **34**: 99. 1895. (*Uredo*, N. Am. Fl. **7**: 614, 1924.)

On *Parsonsia Parsonsia* (L.) Britton, Bajabonico, March 23, *80*.

68. UREDO HAMELIAE Arth. Mycologia **8**: 23. 1916. (*Uredo*, N. Am. Fl. **7**: 617, 1924.)

On *Hamelia erecta* Jacq., Puerto Plata, March 24, *81*.

69. UREDO IGNAVA Arth. Bull. Torrey Club **46**: 121. 1919. (*Dicaeoma*, N. Am. Fl. **7**: 341, 1920; 783, 1926.)

On *Bambos vulgaris* Schrad., San Pedro de Macoris, March 10, *109*.

70. UREDO JATROPHICOLA Arth. Mycologia **7**: 331. 1915. (*Uredo*, N. Am. Fl. **7**: 613, 1924.)

On *Adenoropium gossypifolium* (L.) Pohl. (*Jatropha gossypifolia* L.), Los Matas, March 28, *106;* San Cristobal, March 12, *94;* Sanchez, Aug. 4, 1918, *John A. Stevenson 7023;* La Vega, Aug. 7, 1918, *John A. Stevenson 7063.*
Curcas Curcas (L.) Britton & Millsp., Haina, March 11, *98;* Puerto Plata, March 24, *85*.

Previously reported both by Fragoso and Ciferri and the N. Am. Fl.

71. UREDO SAPOTAE Arth. & Johnston, Mem. Torrey Club **17**: 169. 1918. (*Uredo*, N. Am. Fl. **7**: 615, 1924.)

On *Sapota Achras* Mill., Santiago, March 20, *34*.

72. **Uredo Toroiana** sp. nov.

On *Vernonia cinerea* (L.) Less., Puerto Plata, March 24, 1926, II, *Kern & Toro 84* (type); San Pedro de Macoris, Feb. 1, *M. F. Barrus*.

II. Uredinia hypophyllous, scattered or somewhat crowded, roundish, 0.3–0.4 mm. in diameter, early naked, pulverulent, yellowish-brown; paraphyses peripheral, numerous, incurved, clavate, often much bent, septate, 14–18 × 40–80 μ, the wall colorless, about 3 μ thick, smooth; urediniospores ellipsoid or obovoid, 19–26 × 22–30 μ, the wall colorless, 1.5 μ thick, moderately and evenly echinulate, the pores obscure.

A very interesting rust which in the field had the general appearance of a *Coleosporium*. A microscopical examination soon

showed that this was not the case. The incurved jointed paraphyses make this species distinctive. In this regard and in host-relationship there is a close parallel to *Uredo Vernoniae-hookerianae* Petch (Ann. R. Bot. Gard. Peradeniya, III, **7**: 213, 219, 1917) from Ceylon. It is most certainly the same type of rust and the two undoubtedly belong to the same genus. Differences in the sori, in the size of the spores and paraphyses, and in the walls of the paraphyses, have prevented me from considering these two to be the same species. The name is in honor of my associate.

73. **Uredo bullula** sp. nov.

On *Eupatorium* sp., Santiago, March 22, 1926, II, *Kern & Toro 8*.

II. Uredinia hypophyllous, scattered, roundish, pustular, 0.3–1 mm. across, long covered by the brown overarching epidermis, finally opening by an irregular central break; paraphyses none; urediniospores broadly ellipsoid or obovoid, sometimes compressed and irregular, 23–26 × 27–32 μ, the wall cinnamon-brown, 1.5 μ thick, moderately and evenly echinulate, the pores 2, opposite and equatorial.

A species distinctive on account of the firm blister-like sori. In this regard it is quite different from an ordinary pulverulent form like *Uredo eupatoriicola* P. Henn. from Brazil. It is somewhat more like *Uredo suspecta* Jackson & Holway, from Costa Rica, but the spores of that species are larger, rougher, thicker-walled, and the sori are not bullate.

SPECIES PREVIOUSLY REPORTED FROM SANTO DOMINGO, NOT IN THE FOREGOING LIST

74. COLEOSPORIUM DOMINGENSIS (Berk.) Arth. Am. Jour. Bot. **5**: 329. 1918.

Uredo domingensis Berk. Ann. Mag. Nat. Hist. II. **9**: 200. 1852.

Coleosporium Plumierae Pat. Bull. Soc. Myc. Fr. **18**: 178. 1902. (N. Am. Fl. **7**: 87, 1907; 652, 1924.)

On *Plumiera rubra* L. Ex-Herb. Kew, No. 78, probably part of type (locality unknown—collector unknown—published in a paper by Berkeley, "Enumeration of some fungi

from Santo Domingo." See Arth. Am. Jour. Bot. **5**: 329. 1819).

This rust is known also from Bahamas, Guatemala, and Panama.

75. PHAKOPSORA FENESTRALA Arth. Bull. Torrey Club **44**: 508. 1917. (N. Am. Fl. **7**: 674, 1925.)

On *Phyllanthus grandifolius* L., La Romana, Dec. 1–3, 1909, *N. Taylor 365.*

Reported in the N. Am. Fl.

76. PHAKOPSORA MEIBOMIAE Arth. Bull. Torrey Club **44**: 509. 1917. (N. Am. Fl. **7**: 673, 1925.)

On *Meibomia tortuosa* (Sw.) Kuntze, prope Maniel de Ocoa, October, 1910, *H. von Turckheim Phan. no. 3656.*

Reported in the N. Am. Fl.

77. TRANZSCHELIA PUNCTATA (Pers.) Arth. Résult. Sci. Congr. Bot. Vienne 340. 1906. (N. Am. Fl. **7**: 151, 1907; 720, 1926.)

On *Prunus spinosa* L. (cult.), Moca, January, 1927, II, *R. Ciferri.*

Reported by Ciferri and Fragoso (Bol. R. Soc. Esp. Hist. Nat. **27**: 267, 1927) as *Puccinia Pruni-spinosae* Pers. which is a synonym of the name here used.

78. UROMYCES COMEDENS Syd. Monog. Ured. **2**: 37. 1910.

On *Jasminum pubescens* Willd., Haina, April 18, 1925, *R. Ciferri 851.*

This species is closely related to *Uromyces Hobsoni* Vize (Grevillea **4**: 115, 1876) from which it differs in having larger aeciospores and in having its teliospores built into the aecial cups which retain their shape. *U. Hobsoni* is on *Jasminum grandiflorum.* Sydow does not describe pycnia for *U. comedens* but Fragoso and Ciferri (Bol. R. Soc. Esp. Hist. Nat. **25**: 356, 1925.) do. I have a specimen but it is too fragmentary for me to decide the question of relationship between these two rusts.

79. UROMYCES TRICHOLAENAE Frag. & Cif. Bol. R. Soc. Esp. Hist. Nat. **25**: 357. 1925.

On *Tricholaena rosea* Nees, Haina, June 28, 1925, *R. Ciferri 90.*

Reported by Fragoso and Ciferri, Bol. R. Soc. Esp. Hist. Nat. **25**: 357 (1925), as a new species *ad interim.*

The rust to be expected on this host is *Puccinia levis.* In the part of the type available only urediniospores are found which agree well with *P. levis.* Fragoso and Ciferri describe 1-celled teliospores. My specimen is too fragmentary to lead to a decision which would satisfactorily determine its standing.

80. PUCCINIA ARTHURELLA Trotter in Sacc. Syll. Fung. **23**: 694. 1925. *Puccinia proximella* Arth. Bull. Torrey Club **47**: 471. 1920. (*Dicaeoma*, N. Am. Fl. **7**: 439, 1921.)

On *Brachyramphus intybaceus* (Jacq.) DC. (*Lactuca intybacea* Jacq.), Azua, March 18, 1913, *Rose, Fitch & Russell Phan. no. 4015.*

Reported in the N. Am. Fl.

81. PUCCINIA PLUCHEAE (Syd.) Arth. Bull. Torrey Club **49**: 194. 1922. (*Dicaeoma*, N. Am. Fl. **7**: 793, 1926.)

On *Pluchea purpurascens* (Sw.) DC., San Pedro de Macoris, March 31, 1913, *Rose, Fitch & Russell Phan. no. 4294.*

Reported in the N. Am. Flora.

82. PUCCINIA POLYSORA Underw. Bull. Torrey Club **24**: 86. 1897. (*Dicaeoma*, N. Am. Fl. **7**: 279, 1920.)

On *Tripsacum dactyloides* L., Constanza, May, 1910, *H. von Turckheim Phan. no. 3320.*

Reported in the N. Am. Fl.

83. PUCCINIA XANTHII Schw. Schr. Nat. Ges. Leipzig **1**: 73. 1822. (*Micropuccinia*, N. Am. Fl. **7**: 571, 1922.)

On *Xanthium chinense* Mill., Sanchez, Apr. 2, 1913, *Rose, Fitch & Russell Phan. no. 4351.*

Reported in the N. Am. Fl.

84. AECIDIUM DOMINICANUM Frag. & Cif. Bol. R. Soc. Esp. Hist. Nat. **26**: 249. 1926.

On *Ipomoea* sp., Haina, Nov. 20, 1925, *R. Ciferri.*

Reported by Ciferri and Fragoso.

85. UREDO BIXAE Arth. Mycologia **7**: 327. 1915. (*Uredo*, N. Am. Fl. **7**: 613, 1924.)

On *Bixa orellana* L., Haina, June, 1925, *R. Ciferri.*

Previously known only from Porto Rico.

Reported from Santo Domingo by Fragoso and Ciferri, Bol. R. Soc. Esp. Hist. Nat. **25**: 443. 1925.

86. UREDO EICHORNIAE Frag. & Cif. Bol. R. Soc. Esp. Hist. Nat. **27**: 69. 1927.

On *Piaropus crassipes* (Mart.) Britton (*Eichornia crassipes* Solms), Haina, February, 1926, *R. Ciferri.*

The authors say they found no rust reported on this host and therefore describe this as a new species. The urediniospores are 21–24 × 22–26 μ, the wall 3.5 μ thick, sparsely verrucose, with 3–5 pores; paraphyses are numerous, linear or clavate, and incurved. According to the illustration the pores are scattered. I have not seen a specimen.

HOST INDEX

Adenoropium gossypifolium
Uredo jatrophicola
Andropogon Sorghum sudanensis see **Holcus Sorghum**
Arachis hypogaea
Puccinia Arachidis
Artocarpus communis
Uredo artocarpi

Bambos vulgaris
Uredo ignava
Bastardia viscosa
Puccinia heterospora
Bihai Bihai
Puccinia Heliconiae
Bixa Orellana
Uredo Bixae
Borreria laevis
Puccinia lateritia
Brachyramphus intybaceus
Puccinia Arthurella
Byrsonima crassifolia
Crossopsora notata

Cajan Cajan
Uromyces Dolicholi
Canna sp.
Puccinia Cannae
Capriola Dactylon
Puccinia Cynodontis
Cardiospermum microcarpum
Puccinia Arechavelatae
Cassia crista
Ravenelia spinulosa
Cenchrus echinatus
Cenchrus viridis
Puccinia Cenchri
Chamaesyce hirta

Chamaesyce hypericifolia
Chamaesyce prostrata
Uromyces proëminens
Chloris ciliata
Chloris paraguayensis
Puccinia cacabata
Cissus sicyoides
Endophyllum circumscriptum
Coccolobis uvifera
Uredo Coccolobae
?**Cornutia pyramidata**
Puccinia Urbaniana
Croton angustatus
Phakopsora dominicana
Curcas Curcas
Uredo jatrophicola
Cyperus ferax
Puccinia canaliculata

Dichromena ciliata
Puccinia Dichromenae
Dryopteris subtetragona
Desmella superficialis

Eichornia crassipes see **Piaropus crassipes**
Elephantopus mollis
Coleosporium Elephantopodis
Eleutheranthera ruderalis
Puccinia Melampodii
Eupatorium sp.
Uredo bullula

Ficus Carica
Cerotelium Fici
Funastrum clausum
Puccinia obliqua

Gaya occidentalis
Puccinia heterospora
Gouania lupuloides
Puccinia Gouaniae
Puccinia invaginata
Gouania polygama
Puccinia Gouaniae
Gossypium barbadense
Cerotelium desmium

Hamelia erecta
Uredo Hameliae
Hippocratea volubilis
Botryorhiza Hippocrateae
Holcus halepensis
Holcus Sorghum
Puccinia purpurea
Hyptis capitata
Puccinia Hyptidis
Hyptis suaveolens
Puccinia medellinensis

Indigofera mucronata
Indigofera suffruticosa
Ravenelia Indigoferae
Inga Inga
Ravenelia Ingae
Ipomoea sp.
Aecidium dominicanum
Isandrina emarginata
Ravenelia portoricensis

Jacquemontia nodiflora
Uromyces gemmatus
Jambos Jambos
Puccinia Psidii
Jasminum pubescens
Uromyces comedens

Lactuca intybacea see **Brachyramphus intybaceus**
Lantana involucrata
Puccinia Lantanae
Lasiacis divaricata
Uromyces leptodermus
Leonotis nepetaefolia
Puccinia Leonotidis
Lonchocarpus domingensis
Ravenelia Lonchocarpi

Malvastrum corchorifolium
Malvastrum coromandelianum
Puccinia Malvacearum
Meibomia cana
Meibomia scorpiurus
Uromyces Hedysari-paniculati
Meibomia tortuosa
Phakopsora Meibomiae
Melanthera sp.
Uromyces columbianus
Mesosphaerum capitatum see **Hyptis capitata**

Mesosphaerum suaveolens see **Hyptis suaveolens**
Mimosa Ceratonia
Ravenelia Caesalpiniae

Panicum barbinode
Uromyces leptodermus
Panicum fasciculum
Panicum maximum
Puccinia levis
Parsonsia Parsonsia
Uredo Cupheae
Paspalum conjugatum
Puccinia tubulosa
Paspalum lindenianum
Puccinia Chaetochloae
Paspalum plicatulum
Puccinia tubulosa
Pavonia coccinea
Kuehneola malvicola
Phyllanthus grandifolius
Phakopsora fenestrala
Piaropus crassipes
Uredo Eichorniae
Pluchea purpurascens
Puccinia Plucheae
Plumiera rubra
Coleosporium domingensis
Priva lappulacea
Puccinia Lantanae
Prunus spinosa
Tranzschelia punctata

Salvia occidentalis
Puccinia impedita
Sapota Achras
Uredo Sapotae
Scleria secans
Puccinia scleriicola
Sida spinosa
Sida urens
Sida sp.
Puccinia heterospora
Sporobolus Berteronianus
Puccinia hibisciata
Sporobolus indicus
Uromyces ignobilis
Stigmaphyllon lingulatum
Puccinia inflata
Synedrella nodiflora
Puccinia Melampodii
Syntherisma sanguinalis
Puccinia tubulosa

Tabebuia sp.
Prospodium Tabebuiae
Tecoma Stans
Prospodium appendiculatum
Tournefortia hirsutissima
Aecidium Tournefortiae
Tricholaena rosea
Uromyces Tricholaenae
Trichostigma octandrum
Puccinia Rivinae
Tripsacum dactyloides
Puccinia polysora
Triumfetta semitriloba
Triumfetta sp.
Pucciniosira pallidula

Valerianodes cayennense
Endophyllum Stachytarphetae
Valerianodes jamaicense
Puccinia Urbaniana
Valota insularis
Puccinia tubulosa
Vernonia cinerea
Uredo Toroiana
Vernonia racemosa
Puccinia insulana
Vernonia Spregeliana
Puccinia fuscella
Vigna repens
Uromyces appendiculatus

Wedelia Ehrenbergii
Wedelia reticulata
Uromyces piauhyensis

Xanthium chinense
Puccinia Xanthii

Zea Mays
Puccinia pallescens
Puccinia Sorghi

DEPARTMENT OF BOTANY,
THE PENNSYLVANIA STATE COLLEGE

NOTES ON THE SYNONYMY OF SOME SPECIES OF HYPOXYLON

C. L. Shear

For many years the writer has been making more or less desultory studies of *Hypoxylon*. During this period we have had an opportunity to examine the types or authentic material of most of the older species described by European and American authors. These studies have shown that there is considerable error and confusion in the interpretation of the species. While the study of type material is helpful in giving us more exact knowledge of the character of the species, especially the spores, still it is necessary to have a broad field knowledge of the species and a large amount of material from different regions showing all stages and conditions of their development in order to reach dependable conclusions. A careful study is needed, especially of the conidial forms. Very little attention has ever been paid to these. The few observations and comparisons which have been made show that in some cases, at least, species which can scarcely be distinguished in their mature form show easily recognizable differences in their conidial stages.

The assumption that stromatic characters are constant and specific in this genus has led to many mistakes in the segregation and recognition of the species. How constant or reliable such characters may be in any species can only be determined by an examination of a large quantity of material collected in different localities and under different conditions. In *Hypoxylon coccineum*, for instance, the stromata are unusually constant in shape and other characters, varying mostly in size only. In *H. multiforme*, on the other hand, the stromata are very variable in shape, ranging from the common pulvinate form through all sorts of irregular forms to an effuse stroma similar to that of *H. rubiginosa*.

The same is true of spore characters. In some species the range of variation in the spores in size and shape is very slight

whereas in other species there is considerable range of variation, making it very difficult to determine the specific limitations.

Notes on the synonymy of the following species are given in alphabetical order.

H. annulatum (Schw.) Curt. = effuse form of *H. marginatum* (Schw.) Berk. q.v.

H. atropurpureum Fr. = *H. multiforme* Fr. q.v.

H. atrorufum Ellis & Ev. = *H. cohaerens* (Pers.) Fr. q.v.

H. bifrons De-Not. = *H. Sassafras* (Schw.) Curt. q.v.

H. Blakei Berk. & Curt. = *H. Morsei* Berk. & Curt. q.v.

H. callostroma (Schw.) Berk. = *H. Sassafras* (Schw.) Curt. q.v.

H. caries (Schw.) Sacc. = *H. serpens* (Pers.) Fr. q.v.

H. Catalpae (Schw.) Sacc. = *H. perforatum* (Schw.) Curt. q.v.

H. COCCINEUM Bull. = *H. enteromelum* (Schw.) Cooke = *H. Howeianum* Peck.

A specimen of *Sphaeria enteromela* from the herbarium of Schweinitz preserved in Michener's herbarium is a mere form of *H. coccineum*. The specimen consists of two pieces of bark, one apparently beech and the other chestnut. In the first the stromata are young; in the second they are nearly mature and are typical *coccineum*. Cooke, who examined specimens from Schweinitz in Berkeley's herbarium, says the spores are $10 \times 3\ \mu$, which is the usual size for *coccineum*.

H. Howeianum of Peck, according to our measurements made from part of the type collection, has spores $8–10 \times 4\ \mu$. Peck says this is allied to *H. fragiforme*, but is larger and has a punctate surface and smaller spores. He, however, gives no spore measurements. We adopt *H. coccineum* as the name for this species on the basis of its wide general usage and correct application, although older names have evidently been applied to it. This species we also regard as the type of the genus *Hypoxylon*.

H. COHAERENS (Pers.) Fr. = *H. turbinulatum* (Schw.) Ellis & Ev. = *H. atrorufum* Ellis & Ev.

The types of these two species in the herbaria of their authors show the same sized spores, $9–12 \times 4–5\ \mu$, and have the typical form of this well-known and characteristic species. *H. atrorufum* was in a fresh, just maturing condition in which the stroma is

usually a very dark reddish color. Schweinitz's species is a mere form in which the stromata are a little more uniform and elevated than the type of *H. cohaerens*.

H. colliculosum (Schw.) = *H. serpens* (Pers.) Fr. q.v.

H. decorticatum (Schw.) Berk. = *H. perforatum* (Schw.) Curt. q.v.

H. durissimum (Schw.) Cooke = *H. perforatum* (Schw.) Curt. q.v. and not *H. marginatum* as per Ellis & Ev. N. A. Pyren. 640.

H. enteromelum (Schw.) Cooke = *H. coccineum* Bull. q.v.

H. Howeianum Pk. = *H. coccineum* Bull. q.v.

H. MARGINATUM (Schw.) = *H. annulatum* (Schw.) Curt.

The specimen of *Sphaeria marginata* No. 1176, in Schweinitz's mounted collection, has ascospores 7.5–10 × 4–5 μ, mostly 8 × 4 μ. *H. annulatum*, as shown by Schweinitz's original illustration and authentic specimens, is simply an effuse form of *marginatum* which sometimes shows more or less scattered perithecia, especially when found on decorticated wood. The spores and other characters are practically the same. Schweinitz apparently concluded that these two names were synonyms, as he did not include *annulatum* in his North American Fungi. Although the specific name *annulatum* (1825) has priority over *marginatum* (1832), the name *marginatum* should be adopted for the species on account of its wide general use for this common species and because it was applied to the most common form of the species.

The name *H. annulatum*, as used by Montagne and attributed to Fries, probably refers to another species. *Sph. marginata* Fr. (1828) is, according to the original description, a *Nummularia*, probably *N. discreta*, according to Saccardo and Ellis.

H. MULTIFORME Fr. = *H. granulosum* Bull. = *Sphaeria rubiformis* Pers. = *H. atropurpureum* Fr. = *H. transversum* (Schw.) Sacc.

Authentic specimens of Fries have spores 10–12 × 4–5 μ. *H. granulosum* is accepted as a synonym on the basis of Bulliard's illustration and the authority of Persoon, Fries and others. Persoon's type of *Sphaeria rubiformis* agrees entirely with this species. *H. atropurpureum* has not before been considered a

synonym of this species but an examination of authentic specimens of Fries issued in his "Scleromycetes Suecica" shows that this is only an effuse condition of *multiforme*, it having all the other stromatic and spore characters. Intergrading forms are frequently found as to the shape of the stroma. *H. transversum* (Schw.) Sacc. differs only from typical *multiforme* in that the stromata arise in transverse cracks in the bark of birch, the host upon which it is most commonly found. Spores and all the other characters of Schweinitz's specimens agree entirely with this species.

H. PERFORATUM (Schw.) Curt. = *H. Catalpae* (Schw.) Sacc. = *H. decorticatum* (Schw.) Berk. = *H. durissimum* (Schw.) Cooke.

H. perforatom is a rather variable species, especially as to size, shape and color of the stromata. When occurring on bark the stromata are usually small, irregular, pulvinate to subglobose, and when occurring on decorticated wood they are frequently effuse and very similar to *H. rubiginosum*. The spores according to measurements made from Schweinitz's original collection, apparently on *Liquidambar*, range from 11–15 × 5–7.5 μ, mostly 11–12 × 5–6 μ. Schweinitz's specimens of *H. Catalpae* show the effuse form of the stroma with spores mostly 11 × 5.5 μ. His specimen of *H. decorticatum* is the effuse form on decorticate wood with ascospores mostly 11 × 5 μ and is not a synonym of *H. marginatum* as given by Ellis and Everhart. This species is very close to *H. rubiginosum* Pers. and it may be that intergrading forms occur. Much more thorough and careful study of *H. rubiginosum* in all its forms and conditions is needed to define satisfactorily its specific limits and synonymy.

H. SASSAFRAS (Schw.) Curt. = *H. callostroma* (Schw.) Berk. = *H. bifrons* De-Not. = *Rosellinia Linderae* Peck. = *Rosellinia prinicola* Berk. & Curt.

The spores of Schweinitz's specimens of *H. Sassafras* range from 8–11 × 3–5 μ. This species is very variable in the aggregation and arrangement of the perithecia which are rather frequently scattered and sometimes separate. This has led to the description of the latter forms under the genus *Rosellinia*. An examina-

tion of the type or authentic material of the synonyms given shows that they correspond in spore size and in the character of the perithecia and the yellow layer surrounding them. The rather unusual characteristic of this species seems to be its host restriction, being found at present only on hosts belonging to the Lauraceae. Berkeley and Curtis' *R. prinicola* was so named on account of an incorrect identification of the host. The type is clearly on *Lindera* and not on *Prinus*. *Sphaeria corticata* Pers. in Herb. is the same plant. This name was never published apparently. The specimen was sent from Pennsylvania by Muhlenberg and is on *Lindera*.

H. SERPENS (Pers.) Fr. = *H. caries* (Schw.) Sacc.

The spores in Persoon's type are 11–15 × 5.5–6.5 μ, mostly 12.5 μ long. In Schweinitz's type the spores are 9–14 × 5–6 μ. The black line penetrating the wood below the stroma in this species is supposed to be characteristic. It, however, does not appear from our observations to be a constant character, but seems to depend upon the condition of the wood upon which it is growing.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

DARK-FIELD MICROSCOPY IN THE STUDY OF FUNGI

Edwin E. Honey and W. R. Fisher[1]

(With Plate 13)

During a monographic study of the monilioid species of *Sclerotinia*, by the senior writer, it became desirable to photograph certain microscopic structures such as asci, ascospores and paraphyses. In all species of this group studied, these structures appear hyaline or nearly so and for this reason present a problem quite distinct from that of similar dark colored structures. Where color is present in the object contrast is readily secured with the bright-field microscope. Hyaline objects are not so readily visible, and to enhance their visibility it is necessary to greatly reduce the amount of light transmitted through them. Even by a reduction of light in the bright-field, certain details of hyaline objects are not visible or are not so distinct as in the dark-field. The adaptability of dark-field illumination to the study of living hyaline unstained material as is illustrated in this paper is one of its advantages over the bright-field. Beck and Gage (1925: 428) firmly maintain not only that the dark-field microscope makes objects visible but also that the maximum resolution may be obtained. In fact Beck is quoted (Gage, 1925: 428) as saying, "Anything that can be resolved by transmitted illumination can be resolved by dark-ground illumination, and in general with much greater brilliancy, because of the increased contrast between different parts of the structure."

So far as the writers are aware, dark-field microscopy has not been applied to the study and photography of the morphological structures of the higher fungi. Atkinson (1900) in photographing gross characters of the Agaricaceae and other fungi, Dickson and Fisher (1923) in photographing spore-clouds arising from dis-

[1] For the critical reading of the manuscript, the writers are indebted to Professor H. H. Whetzel, Dr. H. M. Fitzpatrick, Dr. L. M. Massey and Dr. S. H. Gage.

charging apothecia, and others have made use of the *black background* to aid in resolution. Noguchi (1919) used dark-field microscopy for the study and photography of the organism causing yellow fever, and Park and Williams (1920: 71–72) report the use of the dark-field in the study of such organisms as *Treponema pallidum* and the flagella on certain bacteria. Gaidukov (1910) has given a very complete review of the uses to which dark-field illumination has been put in the biological field, including observations on bacteria, myxomycetes, flagellates, beer yeasts, algae, etc. The writers have made use of dark-field microscopy in the study of the morphology and in connection with the photography of several North American species of *Sclerotinia*. Fresh living material has been studied in all of the dark-field work. We were most fortunate in receiving suggestions and the loan of some of the apparatus used in the work, from Doctor Simon H. Gage.

The principles and details of application of dark-field illumination have been ably discussed and illustrated by Gage (1925) in the fourteenth revision of his text, "The Microscope," and by Chamot (1921). Since in dark-field illumination the rays pass through the condenser in a hollow cone, sufficiently oblique as not to pass directly into the objective, the object, which in our case consists of spores, ungerminated or germinated, asci and paraphyses, appears light in a dark background. While the reader is referred to Gage (1925), Chamot (1921), Barnard and Welch (1925) or other authorities on dark-field illumination and photomicrography for details, it may be worth while to mention some of the essentials which we have found necessary for success in its use with fungi:

1. The objects must be in a medium of a refractive index different from themselves. We have found distilled water free from crystals or other particles satisfactory for this purpose. The greater the difference between the refractive index of the object and the medium in which it is suspended the brighter will be the appearance of the object. The age of the fungous object used seems to affect somewhat its ability to refract light, for asci which were either quite immature or from apothecia far beyond their prime were less satisfactory. All experiments with thin films of agar, as media for mounting the objects upon thin slides to con-

form to the limits of thickness required by the dark-field condenser, proved unsatisfactory. . The agar film introduced more difficulties in connection with the lighting, and is more tedious, and was abandoned in favor of the water medium.

2. The objects must be scattered in the dark-field, for if there are no intervening spaces the entire field will be bright, and the details not being distinct cannot be studied advantageously. Therefore, in making mounts care should be taken to properly tease apart the asci and paraphyses, and have these objects uniformly dispersed throughout. When ascospores are to be photographed, apothecia attached to the top of a deep petri dish should be allowed to discharge them directly into a small drop of distilled water on a slide of the proper thickness. If the spore suspension is found to be too concentrated, it should be diluted by transferring to other drops of distilled water on other slides. By allowing the spores to discharge into the water, it will be found easier to keep out foreign particles or bits of tissue from the apothecium. Such debris will also reflect light and thus make the spores less distinct.

3. Cover-glasses and microscope slides of the proper thickness must be used. This thickness will vary with the refracting condenser used. Most condensers have the equivalent focus and working distance marked on them, and this should be consulted, and slides and cover-glasses selected accordingly by use of micrometer calipers. If this is done, the focus of the condenser is brought to the upper surface of the microscope slide where the object is situated, and thus the most satisfactory illumination secured. The dark-field condenser used by the writers was labelled with a slide thickness of 1.45–1.55 mm. Slides ranging between these extremes, preferably those of 1.50 mm., were used. Thin square cover-glasses, 0.15–0.18 mm. in thickness, were employed in order to allow for the proper working distance for the objective used.

4. The object should be mounted in as thin a film of water as possible. This is to insure the greater probability of finding the entire object in the same focal plane. Elongate objects, such as asci, will cause more difficulty in this respect than shorter objects such as spores. Success depends as much upon this one condition

as upon any other, and next to the lighting problem, is the greatest limiting factor in securing satisfactory results. If the thickness of the slide recommended by the maker of the condenser should not prove satisfactory, it may be necessary to determine the thickness best suited to the particular apparatus. A method for accomplishing this is given by Gage (1925: 443–445).

5. The mount must be sealed by a thin layer of shellac or gold-size applied with camel's hair brush about the edge of the cover-glass. This attaches the cover firmly to the slide and prevents evaporation with the resulting movement of the object during exposure.

6. Slides and cover-glasses must be thoroughly cleaned. We are indebted to Dr. Gage for suggesting the method, which he has since published (1925: 315–316), and which has proved very satisfactory. This is the use of Bon Ami emulsion (5 gr. stirred up in 100 cc. of water) into which the slides are placed and stirred, and then taken out one by one and set up on end on blotting paper to dry. The thoroughly dried slides are kept in a covered container and, when needed, wiped well with a piece of fresh gauze. Cover-glasses are treated in the same way.

7. The arrangement and source of light is of prime importance. A dimly lighted room should be chosen in which to work, the curtains drawn, when necessary, to eliminate direct sunlight. The source of light is very important. Direct sunlight is said to be the best, but it is not so satisfactory for continuous observation. Next to sunlight the arc lamp gives the most brilliant light, but we have found, under our set of conditions, that the 6-volt headlight lamp, described by Gage (1925: 447), is most suitable. In fact, for part of the work, we are indebted to Dr. Gage for the loan of a lamp of this type. When the Bausch and Lomb euscope was used, the lighting system supplied with it also proved satisfactory. The ideal to be sought in setting up and adjusting the apparatus is a perfectly black field, allowing only the light reflected from the object to pass into the microscope. Tests have shown that there is a certain amount of adventitious light entering the microscope, tending to render the background grayish, and that this increases with the brilliancy of the illumination even when the condenser, the microscope slide, the mirror,

etc., are most favorably arranged. We have found it desirable, therefore, in some of the work to lessen the intensity of the light by placing a sheet of ground-glass in front of the condenser mirror in the path of the light from the lamp, as suggested by Gage (1925: 453). The closer the ground-glass is set to the microscope mirror, the more brilliant the light. A ground-glass whose surface had been oiled and from which the excess of oil had been rubbed was also used to some extent to avoid subduing the light too much. Also the field may be made darker by closing the iris more or less when a paraboloid condenser is employed, although this is not desirable with a cardioid condenser, for the most desirable part of the light would then be cut off. The lowering of the intensity of the light, as described above, will necessitate the increase of time exposure in making the photograph. With some objects where movement from the plane in which they have been focused for photographing or rotation motion is evident, it may be more desirable to allow more light and give shorter exposure. The time of exposure will vary, also, according to the distance of the source of light from the substage mirror.

8. The numerical aperture of the objective must be less than that of the dark-field condenser in order to secure a dark-field. Unless one is in the possession of immersion objectives of correct numerical aperture, designed primarily for dark-field microscopy, it will be necessary when using immersion objectives to place a funnel-stop into the back of the objective in order to block out direct rays which would otherwise give rise to a bright field.

9. In connection with the lighting it is important to properly center and adjust the substage dark-field condenser. The condenser should be raised to a level with the upper face of the microscope stage in order to be close to the slide. A drop of immersion oil must be placed on the top of the condenser. When the slide is in place, there will be a film of oil between the top of the condenser and the underside of the slide. This is true when either a dry or an oil-immersion objective is used. The small ring in the middle of the upper face of the dark-field condenser will aid in centering the condenser exactly in the field and this can be adjusted and maintained by means of the centering screws on the condenser. This important detail, as well as the method of

focusing the dark-field microscope with immersion objectives, is more fully treated by Gage (1925: 455–457).

If there is difficulty in securing a satisfactory dark background, it may be because (1) of an improper adjustment of the diaphragm on the stage or in the substage condenser; (2) of an aperture in the immersion objective unsuitable for the condenser resulting in direct light entering the objective; or (3) of air bubbles in the immersion-oil either between the condenser and the microscope slide or between the immersion objective and the upper surface of the cover-glass.

10. In selecting a room and the support for setting up the dark-field apparatus, consideration should be given to the possibility of vibrations affecting the final result of the exposures. The danger of trouble from this source increases with the higher objectives and the longer time of exposure.

In the first photographs of fungous structures attempted by the writers, a compound microscope with ordinary 4 mm. and 1.9 mm. objectives and a 10 × ocular was employed. Oculars and objectives of various magnifying powers were tested. Where oil-immersion objectives were used it was necessary to insert a funnel-stop in the back of the objectives to lessen the numerical aperture. The condenser used was a Bausch and Lomb paraboloid dark-ground illuminator. An ordinary vertical photographic camera (Bausch and Lomb) was adjusted to the ocular of the compound microscope after the object was in focus. The focus was then verified on the ground-glass of the camera above, the plate inserted, and the exposure made. Satisfactory results were obtained.

In the spring of 1925, the Bausch and Lomb Optical Company of Rochester, New York, placed at the disposal of the Department of Plant Pathology, Cornell University, for trial, one of their euscopes. The writers were fortunate in being able to use this apparatus in studying several species of *Sclerotinia*. The euscope made it possible to study and photograph asci, ascospores, and paraphyses with greater ease and speed than was possible with the vertical camera. It may be helpful at this point to record a typical arrangement of apparatus and the operation as conducted by us in photographing with the dark-field.

(*a*) For photographing asci: Ocular Leitz Periplan 10 ×; objective achromatic 4 mm.; tube length set at 175 mm.; Bausch and Lomb paraboloid dark-field illuminator; Bausch and Lomb euscope with accompanying lighting system; plate used: orthochromatic cut film (4 × 5); microscope slide: thickness between 1.45 mm. and 1.55 mm. (used 1.51 mm., also 1.52 and 1.53 with this condenser); mounting fluid: object in suspension in distilled water and sealed with thin shellac; exposure: a ground-glass was placed in front of the microscope mirror and exposures were made of 4, 8, 10, and 20 seconds. Eight seconds proved to be most satisfactory.

(*b*) For photographing ascospores: The apparatus was the same as above with the following exceptions: Ocular 8 × periplan (Leitz) and 5 × ocular; the 5 × ocular was found to be most satisfactory; objective: achromatic 1.9 oil immersion; mount was made by allowing apothecia to discharge spores directly into a drop of distilled water upon the slide; the thin mount was sealed with shellac; exposure: one second without ground-glass in front of mirror; four seconds with ground-glass seemed too long an exposure.

From our experiments with various oculars and objectives it was concluded (1) that a 3 mm. oil-immersion objective is more satisfactory than a 1.9 mm. or a 4 mm. dry objective since it throws a larger real image than the latter and yet results in less loss of light, and also has a smaller magnification and greater working distance than the former; (2) that increasing magnification with oculars alone (when using a 4 mm. dry objective) has limitations which make it impossible to produce as good results as with the 3 mm. oil-immersion with lower powered oculars.

When the negative from an exposure with the dark-field condenser is printed, the object photographed will appear white on a dark background. If this is successfully carried out, the result is very pleasing. However, a test was made to determine whether satisfactory results could be obtained by making a positive film from the negative and then by printing from the positive, to secure dark objects upon a white background. In cases in which it was tried, this also proved entirely satisfactory (PLATE 13, FIGS. *a* AND *d*), yet we are inclined, in most cases, to

favor the use of the original negative, which gives the dark-field effect. Results typical of the dark-field method of photographing are shown and explained in the accompanying plate (PLATE 13). All figures are made from the untouched films.

DEPARTMENT OF PLANT PATHOLOGY,
CORNELL UNIVERSITY

LITERATURE CITED

Atkinson, G. F. Mushrooms, edible and poisonous, etc. P. i–v, 1–275, *figs. 1–223.* 1900.

Barnard, J. E. & F. V. Welch. Practical photo-micrography. P. i–xii, 1–316, *figs. 1–86, Pl. I—XVI.* (Second edition.) 1925.

Chamot, E. M. Elementary chemical microscopy. P. i–xv, 1–479, *figs. 1–162.* 1921.

Dickson, F. & W. R. Fisher. A method of photographing spore discharge from apothecia. Phytopath. **13**: 30–32, *figs. 1–2.* 1923.

Gage, S. H. The microscope. P. i–ix, 1–517, *figs. 1–277.* (Dark-field edition, 14th revised) 1925.

Gaidukov, N. Dunkelfeldbeleuchtung und Ultramikroskopie in der Biologie und in der Medizin. P. i–vi, 1–83, *Pl. 1–5, figs. 1–13.* (Jena) 1910.

Noguchi, H. Etiology of yellow fever, VI. Cultivation, morphology, virulence, and biological properties of *Leptospira icteroides.* Jour. Exper. Med. **30**: 13–30, *Pl. 1–3.* 1919.

Park & Williams. Pathogenic micro-organisms. P. i–x, 17–786, illustrated (Seventh edition). 1920.

EXPLANATION OF PLATE 13

Fig. *a.* Ascospores of *Sclerotinia fructicola* (Winter) Rehm taken with dark-field (paraboloid) condenser. Printed from the positive of Fig. *b*, instead of the negative. This gives the bright-field effect.

Fig. *b.* Same as Fig. *a*, except printed directly from the negative, thus giving the dark-field effect. Taken with a 4 mm. objective and 10 × periplan ocular. A ground-glass was placed in front of the microscope mirror and an exposure of 18 seconds made.

Fig. *c.* Ascospores of *Sclerotinia Amelanchieris* Reade germinating by the production of microconidia from each pole. Similar arrangement of apparatus as used in Fig. *b.*

Fig. *d.* Ascus of *Sclerotinia Vaccinii-corymbosi* Reade. Printed from positive of Fig. *e.*

Fig. *e.* Ascus of *Sclerotinia Vaccinii-corymbosi* Reade. Printed directly from the negative of Fig. *d.* Used 4 mm. objective and 10 × periplan ocular. A ground-glass was placed in front of mirror. Exposure 8 seconds.

Fig. *f.* Ascus of *Sclerotinia fructicola* (Winter) Rehm. Used 4 mm. objective and 5 × ocular.

Fig. g. Paraphysis of *Sclerotinia fructicola* (Winter) Rehm. Used 4 mm. objective and 10 × ocular.

Fig. *h.* Ascospores (one germinating by means of germ-tube) of *Sclerotinia fructicola* (Winter) Rehm. Used 4 mm. objective and 10 × ocular.

Fig. *i*. Ascospores of *Sclerotinia Vaccinii-corymbosi* Reade (one germinating by means of a germ-tube). Used 1.9 mm. oil-immersion objective and 5 × periplan ocular. Time 1 second without ground-glass in front of mirror.

Fig. *k*. Ascospores of *Sclerotinia Amelanchieris* Reade. Used 4 mm. objective and 10 × ocular.

Fig. *l*. Ascospores of *Sclerotinia Polycodii* Reade. Used 3 mm. oil-immersion objective and 10 × ocular.

Fig. *m*. Ascospores of *Sclerotinia Amelanchieris* Reade. Used 1.9 mm. oil-immersion objective and 10 × periplan ocular. Compare this figure with Figs. *k* and *l*.

Dark-field Microscopy

A KEY TO THE KNOWN AECIAL FORMS OF COLEOSPORIUM OCCURRING IN THE UNITED STATES AND A LIST OF THE HOST SPECIES

George G. Hedgcock[1]

The determination of the aecial forms of *Coleosporium*, viz., the needle forms of *Peridermium*, on species of pine is often a difficult task, especially in the field. The writer has collected and named upwards of 3,000 specimens of this group in the United States. In arranging a key an effort is made to combine for the use of others some of the macroscopic characters noted in this work.

If the collector has a good eye for color tints, he will find that the color of the pycnia in fresh specimens is a good reliable distinguishing character always present. The color is quite constant with mature or nearly mature specimens. The pycnia always appear one to two months before the aecia. They are lighter in color tints when young and immature, but at the time the aecia appear they have assumed their final colors, which are the darker ones in the key.

The grouping and arrangement of both the pycnia and the aecia is also a good diagnostic character. Size and shape, though somewhat variable in some species, can well be taken into account. This key is primarily for use with fresh specimens, but will also aid much in naming dry material.

In collecting specimens, the proximity of any alternate host which might have borne the telia which infected the pines should be noted. Such information will supplement the key in making a determination. The key follows:

I. Dehiscence of the peridium irregularly apical and longitudinal.[2]

A. Aecia usually less in height than in length.

a. Aecia very conspicuous,[3] usually in single extended rows.

[1] The writer acknowledges the assistance of N. Rex Hunt in the earlier work leading to the arrangement of this key.

[2] The term "longitudinal" refers to the direction of the main axis of the leaf.

[3] In general, aecia are very conspicuous when 2 to 3 or more millimeters high

*Aecia irregularly flattened rhomboidal.

Pycnia orange rufous,[4] auburn, or chestnut in color and on yellowed chlorotic areas of the needles.

1. *Peridermium carneum* Bosc., aecial stage (I) of *Coleosporium carneum* (Bosc.) Jacks., on species of *Vernonia.*

**Aecia linguiform to irregularly rhomboidal.

Pycnia cadmium orange to antique brown, on chlorotic areas.

2. *Peridermium Elephantopodis* (Schw.) Hedgc. & Hahn, I of *Coleosporium Elephantopodis* (Schw.) Thüm., on species of *Elephantopus.*

b. Aecia moderately conspicuous and in more or less extended rows.

Pycnia olivaceous black to brownish black, on slightly chlorotic areas..................3. *Peridermium Ipomoeae* (Schw.) Hedgc. & Hunt, I of *Coleosporium Ipomoeae* (Schw.) Burrill, on species of *Convolvulus, Calonyction, Ipomoea* and *Quamoclit.*

Pycnia buckthorn brown to Dresden brown, on yellowed areas.

4. *Peridermium Fischeri* Kleb.,[5] *I of *Coleosporium Sonchi-arvensis* (Pers.) Lév., on species of *Sonchus.*

Pycnia tawny to russet, on chlorotic areas.

5. *Peridermium floridanum* Hedgc. & Hahn, of which the related *Coleosporium* is not established, but may be the form on *Chrysopsis* in Florida.

Pycnia hazel to chestnut brown, on chlorotic areas.

6. *Peridermium Rostrupii* Ed. Fisch.,* I of *Coleosporium Campanulae* (Pers.) Lév., on species of *Campanula* and *Specularia.*

c. Aecia small and inconspicuous, usually clustered or in short rows.

Pycnia dark olive to olivaceous black, on yellowed chlorotic areas.

7. *Peridermium fragile* Hedgc. & Hunt, I of *Coleosporium Laciniariae* Arth., on species of *Laciniaria.*

B. Aecia with height and length about equal.

a. Aecia and pycnia solitary or in extended rows.

Pycnia hazel to chestnut brown, on yellowed chlorotic areas.

and long, moderately conspicuous when 1 to 2 millimeters, and inconspicuous when less than 1 millimeter.

[4] Colors used are those of living specimens, unless otherwise noted, and are those of R. Ridgway, Color standards and color nomenclature, Washington, D. C., 1912.

[5] The specimens examined of species designated by an asterisk (*) were dried exsiccati and the colors may not be quite comparable to those of living specimens.

8. *Peridermium ribicola* (Cooke & Ellis) Long, I of *Coleosporium ribicola* (Cooke & Ellis) Arth., on species of *Grossularia* and *Ribes*.

b. Aecia and pycnia usually in short clustered rows.

Pycnia deep chrome to raw umber, on slightly chlorotic areas.

9. *Peridermium Helianthi* (Schw.) Hedgc. & Hunt, I of *Coleosporium Helianthi* (Schw.) Arth., on species of *Helianthus*.

Pycnia olivaceous black to brownish black, on yellowed chlorotic areas..................10. *Peridermium oblongisporium* Fuckel,*[6] I of *Coleosporium Senecionis* (Schum.) Fries, on species of *Senecio*.

C. Aecia usually greater in height than in length.

a. Aecia and pycnia in single, sometimes extended, rows.

Pycnia yellow ochre to Dresden brown, on slightly chlorotic areas.

11. *Peridermium inconspicuum* Long, I of *Coleosporium inconspicuum* (Long) Hedgc. & Long, on species of *Coreopsis*.

Pycnia old gold to buffy citrine, on yellowed chlorotic areas.

12. *Peridermium californicum* Arth. & Kern, I of *Coleosporium Madiae* Cooke, on species of *Madia* and *Zonanthemis*.

b. Aecia and pycnia clustered and in short rows.

Pycnia grenadine red to mahogany red, on slightly reddened chlorotic areas..................13. *Peridermium acicolum* Underw. & Earle,[6] I of *Coleosporium Solidaginis* (Schw.) Thüm., on species of *Aster* and *Solidago*.

Pycnia orange rufous to mummy brown, on yellowed chlorotic areas.

14. *Peridermium Terebinthinaceae* (Schw.) Hedgc. & Hunt, I of *Coleosporium Terebinthinaceae* (Schw.) Arth., on species of *Silphium* and *Parthenium*.

II. Dehiscence of the peridium circumscissile.

A. Aecia usually less in height than in length.

a. Aecia large and conspicuous.

Pycnia hazel to chestnut brown, on yellowed chlorotic areas.

15. *Peridermium apocynaceum* (Cooke) Hedgc. & Hunt, I of *Coleosporium apocynaceum* Cooke, on species of *Ansonia*.

b. Aecia small and inconspicuous.

Pycnia orange chrome to English red, on reddened chlorotic areas.

16. *Peridermium delicatulum* Arth. & Kern, I of *Coleosporium delicatulum*

[6] *Peridermium montanum* Arth. & Kern which may be distinct is included here.

(Arth. & Kern) Hedgc. & Long, on species of *Euthamia*.

B. Aecia about equal in height and in length.
Aecia small and inconspicuous.
Pycnia tawny to buckthorn brown, on slightly chlorotic areas.
17. *Peridermium minutum* Hedgc. & Hunt, I of *Coleosporium minutum* Hedgc. & Hunt, on species of *Adelia*.
18. *Peridermium Weirii* Arth.[7]

A LIST OF NATURAL PINE HOSTS FOR THE PRECEDING SPECIES

Pinus apacheca Lemm. [*P. Mayriana* (Ellis) Sudw.], (13),[8] (16); *P. Banksiana* Lamb., (4), (6), (9), (13); *P. caribaea* More. [*P. heterophylla* (Ellis) Sudw. and *P. Elliotti* Engelm.], (1), (2), (3), (15), (16); *P. chihuahuana* Engelm., (3); *P. clausa* (Engelm.) Sarg., (1); *P. contorta* Loud. (*P. Murrayana* "Oreg. Com."), (1), (13), (18); *P. echinata* Mill., (1), (2), (3), (9), (11), (13), (14), (16); *P. edulis* Engelm., (8); *P. glabra* Walt., (1), (17); *P. Jeffreyi* "Oreg. Com.," (12); *P. nigra Poiretiana* Schneid. (*P. Laricio* Poir.), (1), (13), (16); *P. nigra austriaca* Schneid. (*P. Laricio austriaca* Endl.), (1), (13); *P. palustris* Mill., (1), (2), (3), (5), (7), (11), (14), (15), (16); *P. ponderosa* Laws., (1), (13); *P. ponderosa scopulorum* Engelm., (1), (13), (16); *P. pungens* Michx., (13), (16); *P. radiata* Don. (*P. insignis* Dougl.), (12); *P. resinosa* Ait., (13), (15), (16); *P. rigida* Mill., (1), (2), (3), (6), (7), (13), (14), (16); *P. serotina* Michx., (1), (2), (3), (13), (14), (16); *P. sylvestris* Linn., (1), (4), (10), (13); *P. taeda* Linn., (1), (2), (3), (7), (13), (14), (15), (16), (17); *P. Thunbergii* Parl., (13); *P. virginiana* Mill., (9), (11), (14).

AN ADDITIONAL LIST OF PINE HOSTS ARTIFICIALLY INFECTED

P. apacheca, (2); *P. canariensis* C. Smith, (2); *P. caribaea*, (13); *P. contorta*, (1), (2), (16); *P. Coulteri* Lamb., (1), (2), (13), (16); *P. glabra*, (16); *P. palustris*, (13); *P. pinea*, (8); *P. radiata*, (2), (13); *P. Sabiniana*, (1).

OFFICE OF FOREST PATHOLOGY,
BUREAU OF PLANT INDUSTRY, WASHINGTON, D. C.

[7] *Peridermium Weirii* Arth. is not known to the writer sufficiently to be incorporated in this key.

[8] Numbers in parenthesis refer to the numbers of the rust species in the foregoing key.

CONTRIBUTIONS TO OUR KNOWLEDGE OF WESTERN MONTANA FUNGI—I MYXOMYCETES

Paul W. Graff

The paucity of our literature on the distribution and especially the phenology of the Myxomycetes is decidedly noticeable. This is particularly true of our northwestern and southwestern states. Colorado has been more fortunate. When once their acquaintance has been made, these little forms of plant life have much to offer that is both interesting and attractive. The secrets of their hidden youth should be exposed, as well as their period of maturity, by greater publicity.

The following species of slime-moulds were collected by the writer in several localities of Montana west of the continental divide. While the list of species is not large, it is the first publication on these plants from that locality. In fact only a very few citations of species of Myxomycetes from this state are to be found in the mycological literature. The majority of the forms enumerated were collected in two quite separated regions. Many were gathered in the vicinity of Yellow Bay located half way up the eastern shore of Flathead Lake, about twenty miles from the city of Polson, and at the base of the Mission Mountains. A considerable portion of the remainder were found in the region around Missoula.

Because of seasonal and climatic conditions, the time best suited to the collection of Myxomycetes in this region is necessarily limited. This is true except for such very localized areas as are found to support a growth of *Thuja plicata*, the western arbor vitae, or other indicators of more or less continuous moisture. Until well into the spring the temperature is too cool. During the very dry summer season the conditions are such that they will cease to develop. The period of spring moisture which lasts usually from the middle of May to the same time in June is best suited to their growth. Again in the early autumn, if

precipitation occurs early enough, there will be a second season when they may develop. These two periods likewise define, though to a somewhat less extent, the time of appearance for the fleshy fungi.

The notes which accompany many of the species are not intended to be more than a statement of conditions as found in these collections. They are for the purpose of either amplifying the available descriptions, or of emphasizing certain points where authorities differ.

1. ARCYRIA DENUDATA (L.) Wetts. Verh. Zool.-Bot. Ges. Wien, 585. 1885–6.

Clathrus denudatus L. Syst. Nat. 1179. 1753.

On twigs of *Alnus tenuifolia* Nutt., Yellow Bay Creek, University of Montana Biological Station grounds, Flathead Lake, Lake County, July 9, 1918; Little Park Creek, Sapphire Mountains, Missoula County, May 27, 1924, at about 4,600 feet elevation.

This conspicuous little species is of very wide distribution. The attachment of its capillitium to the shallow cup, which remains after the rupture of the peridium, helps materially as a distinguishing mark. It is the only brilliantly colored form which has this characteristic, with the exception of the rose-colored *A. insignis* Kalchbr. and Cooke, for which the only North American locality seems to be the state of Massachusetts. The brightly colored red or reddish brown sporangia are from 2–3 mm. in height, and very conspicuous.

2. BADHAMIA NITENS Berk. Trans. Linn. Soc. **21**: 153. 1852.

On decaying bark of *Betula fontinalis* Sarg., Little Dog Creek, vicinity of Olney, Flathead County, July 16, 1924; on twigs of *Acer glabrum* Torr., Miller Creek Canyon, Sapphire Range, Missoula County, May 20, 1925, at about 4,000 feet elevation.

Spores warted on the outside of the spore cluster, more faintly so on the side of contact, 11–13 μ in diameter with the usual size slightly less than the average, about 11.5 μ. From observations on number and arrangement of spores in relation to sporangial size, smoothness or tendency toward echinulation on the adjacent spore surfaces seems to be a matter of duration of close

contact and pressure during development. As a consequence this is a variable characteristic, and a failure as a diagnostic feature.

3. BADHAMIA POPULINA List. Jour. Bot. **13**: 129. 1904.

On log of *Populus trichocarpa* T. & G., Yellow Bay, Flathead Lake, June 28, 1918.

Sporangia crowded, and most frequently sessile except for those outside the cluster, or in rare scattered cases, when they may possess a very short stalk. The spore clusters are not so variable in size as in the case of *B. capsulifera* (Bull.) Berk., with which this species is sometimes merged.

4. BADHAMIA UTRICULARIS (Bull.) Berk. Trans. Linn. Soc. **21**: 153. 1852.

Sphaerocarpus utricularis Bull. Hist. Champ. Fr. 128, *t. 417, fig. 1.* 1791.

On log of *Larix occidentalis* Nutt., Blue Bay, Flathead Lake, July 12, 1918; on decaying log, Pattee Canyon, vicinity of Missoula, Missoula County, May 26, 1919.

5. COMATRICHA FLACCIDA (List.) Morg. Jour. Cinc. Soc. Nat. Hist. **16**: 135. 1894.

Stemonitis splendens Rost. var. *flaccida* List. Monogr. Mycet. 112. 1894.

On twigs among moist leaves, South Fork of the Lolo, Bitter Root Mountains, Missoula County, September 18, 1925, at about 4,000 feet elevation, in stand of *Thuja plicata* D. Don.

Spores of this collection vary from 8.5–11 μ, a slightly higher size range than called for in the original description. The more usual size, however, falls within the characteristic dimensions, being about 9 μ.

6. COMATRICHA TYPHOIDES (Bull.) Rost. Vers. Syst. Mycet. 7. 1873.

Trichia typhoides Bull. Hist. Champ. Fr. 119, *t. 477, II.* 1791.

On decaying wood, Yellow Bay Creek, between Yellow Bay and Bear Trap Mountains, Mission Range, Lake County, July 2, 1921, at about 5,000 feet elevation.

The material though not plentiful is typical. This is not *C. typhoides* (Rost.) List., which Macbride identifies with *Stemonitis virginiensis* Rex. The error seems to be one of interpretation on the part of Lister.

7. CRATERIUM MINUTUM (Leers) Fr. Syst. Myc. **3**: 151. 1829.
Peziza minuta Leers, Fl. Herborn, 277. 1775.

On leaves, vicinity of Blue Bay, Flathead Lake, July 12, 1918; on decaying leaves, Rattlesnake Valley, Missoula County, May 18, 1920, at about 4,200 feet elevation; on leaves of *Acer glabrum* Torr., Yellow Bay Mountain, Mission Range, July 2, 1921, at about 4,000 feet elevation.

The cyathiform, nut-brown or greyish brown sporangia are very typical of the species. The plants in an early stage of development showed their characteristic rich yellow plasmodium.

8. CRIBARIA PURPUREA Schrad. Nov. Gen. Pl. 8. 1797.

On twigs of *Alnus tenuifolia* Nutt., under dense shade on the bank of Pattee Creek, vicinity of Missoula, September 27, 1925, at about 3,800 feet elevation.

9. CRIBARIA RUFA (Roth) Rost. Sluzowce Monogr. 232. 1875.
Stemonitis rufa Roth, Fl. Germ. **1**: 548. 1788.

On twigs, north slope of Mount Sentinel, Hell Gate Canyon, vicinity of Missoula, May 28, 1917, at about 3,600 feet elevation; on partially decorticated log of *Larix occidentalis* Nutt., Yellow Bay Mountain, Mission Range, July 15, 1921, at about 4,500 feet elevation.

10. DIDERMA RADIATUM (L.) Morg. Jour. Cinc. Soc. Nat. Hist. **16**: 151. 1894.

Lycoperdon radiatum L. Sp. Pl. **2**: 1654. 1753.

On partially decorticated log of *Pseudotsuga mucronata* (Raf.) Sudw., vicinity of Yellow Bay, Flathead Lake, July 13, 1920, at about 3,400 feet elevation; on decaying log, Yellow Bay Mountain, Mission Range, July 15, 1921, at about 5,000 feet elevation.

The material of the first collection is typical of the species, while that of the second approaches somewhat var. *umbilicatum* Meyl., with its drab-colored sporangia and irregular mode of

dehiscence. As in other American material, the spore size is slightly smaller than that denoted for the European, their range being 8–11 μ instead of 9–12 μ.

11. DIDYMIUM ANOMALUM Sturgis, Colo. Coll. Publ. Sci. Ser. **12**: 444, *pl. 2, fig. 6–8.* 1913.

On bark of *Populus trichocarpa* T. & G., Yellow Bay, Flathead Lake, July 9, 1921.

The spores of this collection appear minutely warted rather than spinulose as suggested for the species by Macbride. The sporangia are of the plasmodiocarpous form, several centimeters long, and of a dull yellowish grey color. This seems to be a somewhat rare species, as it has been reported from but a few localities in either this country or Europe.

12. DIDYMIUM QUITENSE (Pat.) Torr. Flor. Myxom. 150. 1909.
Chondrioderma quitense Pat. Bull. Soc. Myc. Fr. **11**: 212. 1895.

On fallen leaves of *Betula fontinalis* Sarg., Little Dog Creek, vicinity of Olney, Flathead County, July 14, 1924, at about 3,500 feet elevation; on fallen leaves, South Fork of the Lolo, Bitter Root Mountains, May 23, 1925.

The material of these collections is very close in its characteristics to *Didymium difforme* (Pers.) Duby., which has been reported as rare within the United States. The spore wall is rough, but the reticulations, as well as the violaceous tinge of the spore coat, are decidedly obscure. Both must be very closely related, and it would seem somewhat better to give this varietal distinction under the older name of *D. difforme.*

13. FULIGO INTERMEDIA Macb. N. Am. Slime-Moulds, Ed. II, 30. 1922.

On moss plants under dense shade on the stream bank, Pattee Canyon, vicinity of Missoula, July 12, 1925, at about 4,000 feet elevation.

As this has only been reported from the Rocky Mountain region (the original collections were made in Colorado from whence it seems only to have been reported previously) this may

be but a mountain variety. The genus is composed of such similar and overlapping forms that they offer considerable difficulty in the establishment of distinctive species on sufficient basis for clarity of interpretation. Lister places this as var. *excorticata* under *F. cinerea* Morgan, but it has a cortex!, though thin and fragile.

14. HEMITRICHIA VESPARIUM (Batsch) Macb. N. Am. Slime-Moulds, 203. 1899.

Lycoperdon vesparium Batsch, Elench. Fung. Suppl. I, 253–256, *fig. 171a–c, 172a–d.* 1786.

On twigs of *Betula fontinalis* Sarg., Miller Creek Canyon, Sapphire Range, Missoula County, April 27, 1920, at about 4,500 feet elevation.

This brilliantly colored species is easily recognized by its bright red color and clustered habit in which the sporangia are densely crowded. The spores are not smooth, as described by Rostafinski, but clearly though not strongly warted.

15. LAMPRODERMA COLUMBINUM (Pers.) Rost. Vers. Syst. Mycet. 7. 1873.

Physarum columbinum Pers. Obs. Myc. **1**: 5. 1796.

On twigs of *Betula* sp., Yellow Bay, Flathead Lake, July 9, 1918; on twigs of *Thuja plicata* D. Don, South Fork of the Lolo, Bitter Root Mountains, September 18, 1925.

The material was in fine condition, and typical in all respects.

16. LAMPRODERMA SAUTERI Rost. var. ROBUSTUM (Ellis & Ev.) comb. nov.

Lamproderma robustum Ellis & Ev. in Mass. Monogr. Myx. 99. 1892.

On partially decorticated log of *Pinus ponderosa* Dougl., Yellow Bay, Flathead Lake, July 3, 1921.

Sporangia globose to subglobose, 1–1.5 mm. in diameter, purplish black to black, from a black stalk which is short or as long as the sporangial diameter; columella short, thick, nodulose or widened and flat at the top from which the dense capillitium grows; capillitium dark to purplish brown, delicate and much

branched, anastomosing near the outer periphery to form a fine-meshed network; spores dark purple-brown, minutely echinulate, 12–15 μ.

This American variety is very close to *L. Sauteri* of Rostafinski, but cannot claim relationship with *L. violaceum* Rost., as Lister would have it. Macbride, in his first edition, considers it identical with *L. Sauteri*, but reconsiders and makes them distinct species in the second edition of his monograph. Neither extreme seems to suit the situation. The American material is too close to *L. Sauteri* to be considered separate from it, but distinct enough for varietal status.

17. LEPIDODERMA TIGRINUM (Schrad.) Rost. Vers. Syst. Mycet. 13. 1873.

Didymium tigrinum Schrad. Nov. Gen. Plant. 22. 1797.

On twigs among moist leaves, Deer Creek, vicinity of Bonner, Missoula County, May 21, 1922, at about 4,300 feet elevation; on twigs of *Alnus* sp., Blackfoot Valley, near Twin Creeks, May 30, 1923, at about 3,800 feet elevation.

The purplish, scaly sporangia with dark brown stipes were quite characteristic. These grew from a pale yellow to orange, or in age brownish, hypothallus. The plasmodium was of a pale yellow color.

18. LYCOGALA EPIDENDRUM (Buxb.) Fr. Syst. Myc. **3**: 80. 1829.

Lycoperdon epidendrum Buxb. En. Pl. Hal. 203. 1721.

On decaying log, Yellow Bay Mountain, Mission Range, July 12, 1918, at about 4,200 feet elevation; on decorticated log of *Pinus ponderosa* Dougl., Yellow Bay, Flathead Lake, July 9, 1921; on decaying sticks, Belmont Creek, Blackfoot Valley, Missoula County, May 20, 1925, at about 3,800 feet elevation; on partially decorticated log of *Pseudotsuga mucronata* (Raf.) Sudw., Deer Creek, vicinity of Bonner, Missoula County, July 12, 1925, at about 4,000 feet elevation.

19. PHYSARUM AURISCALPIUM Cooke, Ann. Lyc. Nat. Hist. N. Y. **11**: 384. 1877.

On twigs of *Alnus tenuifolia* Nutt., South Fork of the Lolo, Bitter Root Mountains, May 23, 1925, at about 4,200 feet elevation.

This is possibly synonymous with *Physarum oblatum* Macb., as it is considered by Lister. The two are certainly very closely related, if not identical. Further study and careful comparisons are needed before a positive conclusion can be reached. The larger lime knots of the capillitium and their color, which tends toward the orange-yellow as described by Cooke, seem to be the main point of separation.

20. PHYSARUM BITECTUM List. Monogr. Mycet. Ed. II, 78. 1911.
Physarum Diderma List. in Jour. Bot. **29**: 260. 1891, non Rost.

On sticks of *Betula* sp., Yellow Bay, Flathead Lake, July 2, 1921, at about 3,000 feet elevation; on coniferous twigs, Deer Creek, vicinity of Bonner, May 21, 1922, at about 3,800 feet elevation.

There seems to be some difficulty in distinguishing this species from *Physarum sinuosum* (Bull.) Weinm., with which it appears to be related. The distinction is based largely on spore character, these being decidedly spinulose rather than smooth, and on the purplish color of the inner sporangial wall. In these collections calcium salts are present in the capillitium in the form of coarse irregular white nodules, having very short connections.

21. PHYSARUM BRUNNEOLUM (Phill.) Mass. Monogr. Myx. 280, *fig. 221–222*. 1892.
Diderma brunneolum Phillips, Grevillea **5**: 114. 1877.

On twigs of *Thuja plicata* D. Don, South Fork of the Lolo, Bitter Root Mountains, September 18, 1925, at about 4,500 feet elevation.

Sporangia densely gregarious, stalked, 5–7.5 mm. in diameter, slightly smaller than the typical size for the species. The spores, on the other hand, are of the usual size, 8–10 μ in diameter, and spinulose.

22. PHYSARUM CARNEUM G. List. & Sturgis, Jour. Bot. **48**: 73. 1910.

On decaying log of *Larix occidentalis* Nutt., Little Dog Creek, vicinity of Olney, Flathead County, July 16, 1924, at about 3,700

feet elevation; on twigs of *Acer glabrum* Torr., Rattlesnake Valley, Missoula County, May 24, 1925, at about 4,200 feet elevation.

Sporangia developing from a mustard-yellow plasmodium, usually gregarious but rarely scattered, globose or subglobose, short-stipitate, ochraceous yellow, or with the lower portion varying from flesh-colored to reddish, 0.5–0.6 mm. in diameter. Stalk flesh-colored or reddish, 0.2–0.3 mm. in length. Spores 8–9 μ in diameter, the majority approaching 9 μ, slightly larger than those of Sturgis' material. This species differs from *P. citrinellum* Peck, with which it seems related, in having smaller spores, and in the fact that the latter develops from a greenish white plasmodium with its sporangia borne upon orange-red stalks.

23. PHYSARUM DIDERMA Rost. Sluzowce Monogr. 110. 1875.

Physarum testaceum Sturgis, Colo. Coll. Publ. Sci. Ser. **12**: 18. 1907.

On twigs, Yellow Bay Creek, between Bear Trap and Yellow Bay Mountains, Mission Range, July 12, 1919.

The material of this seldom reported species is very typical, and it is a pleasure to add another locality to the few already enumerated.

24. PHYSARUM POLYCEPHALUM Schw. Syn. Fung. Car. 63. 1822.

On decaying log of *Betula fontinalis* Sarg., Yellow Bay, Flathead Lake, July 10, 1920; on leaves and twigs of *Populus tremuloides* Michx., Pattee Canyon, vicinity of Missoula, June 6, 1923, at about 3,800 feet elevation.

Spores 8–10 μ in diameter, comparing more closely with the dimensions of European material; Macbride reports 9–11 μ as usual for North American collections. The species is common, widely distributed, and quite variable in appearance, particularly respecting sporangial form.

25. PHYSARUM SINUOSUM (Bull.) Weinm. in Fr. Syst. Myc. **3**: 145. 1829.

Reticularia sinuosa Bull. Hist. Champ. Fr. 94, *t. 446, fig. 3.* 1791.

On leaves, Yellow Bay, Flathead Lake, Lake County, July 17, 1921; on leaves, Deer Creek, vicinity of Bonner, Missoula County, August 15, 1925, at about 3,600 feet elevation.

In both cases the sporangia developed the plasmodiocarpous type, growing over the leaves in the characteristic sinuous and branching manner. The prominent snowy white calcareous deposit is well developed, though reported as sometimes wanting, or at least reduced in quantity, in our American forms. The well-developed capillitium does not have as coarse nodules as appear in the case of *P. bitectum* List., with which this species is related, though the general appearance is much the same. Spores smooth, 8–10 μ in diameter.

26. PHYSARUM TENERUM Rex. Proc. Phil. Acad. Sci. 1890: 192. 1891.

On partially decorticated log of *Betula papyrifera* Marsh., shore of Yellow Bay, Flathead Lake, July 12, 1919.

So far as I have been able to ascertain, this is the first report of this species from any of the northwestern states. The growth was quite luxuriant for this delicate little species. Sporangia globose, erect or nodding, with a total height of from 1–2.5 mm., the sporangial head 0.4–0.6 mm. in diameter, the stalk slender, 0.5–1.8 mm. in length. The plasmodium was yellowish in color.

27. RETICULARIA LYCOPERDON Bull. Hist. Champ. Fr. 95, *t. 446, fig. 4.* 1791.

Growing from check cracks on stump of *Pseudotsuga mucronata* (Raf.) Sudw., Yellow Bay, Flathead Lake, June 27, 1918; on stool of *Agropyron spicatum* Scribn. and Sm., base of Mount Sentinel, vicinity of Missoula, May 11, 1924; on grass in street parking, Missoula, April 17, 1925.

This species appears quite frequently in western Montana. One is likely to find it at any time, after the warm spring rains, till the dryer summer season begins, and on a variety of substrata. In the second and third collections the plasmodium had completely left the ground, and the large aethalium was entirely supported in a horizontal position by the grass stalks.

28. STEMONITIS FLAVOGENITA Jahn, Abh. Bot. Ver. Brand. **45**: 265. 1904.

On fallen trunk of *Betula* sp., on north slope of Yellow Bay Mountain, Mission Range, July 12, 1919, at about 5,200 feet elevation.

Plants growing from the characteristic yellow plasmodium, and having the other distinctions which differentiate this species from *S. ferruginea* Ehr., with which it was confused by the earlier workers.

29. STEMONITIS FUSCA Roth, Mag. Bot. **2**: 26. 1787.

On bark of a standing but partially decorticated *Pseudotsuga mucronata* (Raf.) Sudw., Yellow Bay, Flathead Lake, June 28, 1916.

The specimens have the superficial appearance of var. *rufescens* Lister, but the spore size is somewhat larger, 7–9 μ, approaching more nearly the average for the species. Spore reticulations are so slightly developed as to be scarcely discernible.

30. STEMONITIS SPLENDENS Rost. Sluzowce Monogr. 195. 1875.

On the bark of a partially decorticated log of *Populus trichocarpa* T. & G., Yellow Bay, Flathead Lake, July 6, 1918.

Though sometimes confused with *S. fusca* Roth, this species is readily distinguished by its capillitium which arises from the columella at more distant intervals. It is much more open and coarse throughout than will be found in the case of *S. fusca*. The hypothallus is purplish rather than brown.

31. STEMONITIS UVIFERA Macbr. N. Am. Slime-Moulds, Ed. II, 161, *pl. 20, fig. 8, 8a–8c*. 1922.

On fallen trunk of *Picea Engelmanni* (Parry) Engelm., South Fork of the Lolo, Bitter Root Mountains, Missoula County, May 23, 1925, at about 4,300 feet elevation.

The spores of this species have been described as "marked with a cap of minute spines on the side facing outward in the cluster." This seems to be a variable characteristic, and governed by the closeness of contact. When the spore clusters develop somewhat loosely, the amount of surface upon which spines appear increases.

They may even develop over the entire surface. These "spore clusters" should by no means be confused with the spore-balls of the Ustilaginaceae or other similar structures for they are merely the chance contact of a varying number of independent spores. The condition in this case is similar to that noted above for *Badhamia nitens* Berk., where the amount of echinulation appearing on the spore surface varies according to the internal arrangement and pressure during development.

32. TRICHIA AFFINIS De Bary, in Fuckel. Sym. Myc. 336. 1869.

On decaying wood of *Larix occidentalis* Nutt., Yellow Bay, Flathead Lake, July 17, 1918; on wood of *Pseudotsuga mucronata* (Raf.) Sudw., north slope of Yellow Bay Mountain, Mission Range, July 12, 1919, at about 5,000 feet elevation.

Sporangia of a shining golden yellow, changing with age to ochraceous. The luster remains prominent through both the period of development and maturity. Macbride considers this synonymous with *T. persimilis* Karst.

33. TRICHIA DECIPIENS (Pers.) Macbr. N. Am. Slime-Moulds, 218. 1899.

Arcyria decipiens Pers. in Ust. Ann. Bot. **15**: 35. 1795.

On partially decorticated log of *Populus trichocarpa* T. & G., Yellow Bay, Flathead Lake, July 6, 1921.

Very similar in size and general appearance to *Hemitrichia clavata* (Pers.) Rost., which is yellowish to olivaceous in color, rather than the olive to olivaceous brown of this species.

34. TRICHIA PERSIMILIS Karst. in Not. Faun. Flor. Fenn. **9**: 353. 1868.

On twigs of *Acer glabrum* Torr., Deer Creek, vicinity of Bonner, May 21, 1922, at about 3,800 feet elevation.

Closely related to *Trichia scabra* Rost., and *T. affinis* De Bary. It differs from the former in not being as brilliantly colored, and in having slightly smaller peridia, but larger spores. From *T. affinis* it also differs in its more somber color, smaller peridia, and also smaller spores; *T. affinis* having larger spores than either of the other species. The spore sizes for the three, as represented in

these collections, are *T. scabra* 10–12 μ, *T. persimilis* 12–14 μ, and *T. affinis* 13–15 μ; comparable to the dimensions given by Lister (Monogr. Mycet. Ed. III, 1925). With this Macbride does not agree, but gives the spore size in the several instances as the same, 10–12 μ.

35. TRICHIA SCABRA Rost. Sluzowce Monogr. 258. 1875.

On twigs, Yellow Bay Creek, between Bear Trap and Yellow Bay Mountains, Mission Range, July 2, 1921, at about 4,600 feet elevation.

This is a species which seems, from the available information, more common to our northwestern region than to the eastern states.

36. TRICHIA VARIA (Pers.) Fr. Syst. Myc. **3**: 188. 1829.

Stemonitis varia Pers. in Gmel. Syst. Nat. **2**: 1470. 1791.

On twigs of *Acer glabrum* Torr., Yellow Bay, Flathead Lake, July 12, 1919.

Spores minutely warted, 13–16 μ in diameter, yellow in color.

COLUMBIA UNIVERSITY,
NEW YORK CITY